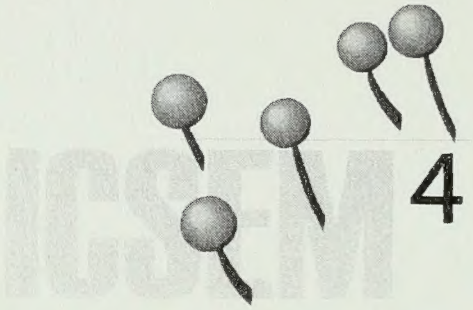
22

ICSEM 4 Congress

August 4 - 9, 2002

ABSTRACTS

International Congress on
Systematics & Ecology of
MYXOMYCETES



International Congress on
Systematics & Ecology of
MYXOMYCETES

Dedicated to the memory of
Mrs. Elly Nannenga – Bremekamp

reading room

J. Rammeloo & A. Bogaerts (eds.)

Fourth International Congress on Systematics & Ecology of Myxomycetes

ICSEM 4

(August 4 - 9, 2002)

Abstracts

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The present book of abstracts (lectures and posters) and participants reflects the state of registration for the ICSEM 4 Congress mid–June 2002. Later registrations are not considered.

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Fourth International Congress on
Systematics and Ecology of Myxomycetes (ICSEM 4)

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Main themes and sessions

FLOR – **Floristics and mycogeography**
Key note speaker: M. Schnittler

FLOR 1 – Tropical Mycetozoans
Key note speaker: S. L. Stephenson

FLOR 2 – Temperate and arctic Mycetozoans
Key note speaker: M. Schnittler

ECOL – **Ecology and special habitats**
Key note speaker: B. Ing

ECOL 1 – Nivicolous Myxomycetes
Key note speaker: M. Meyer

ECOL 2 – Tree canopy and corticolous Myxomycetes
Key note speaker: H. Keller

ECOL 3 – Other special habitats
Key note speaker: S. L. Stephenson

SYST – **Systematics and nomenclature**
Key note speaker: C. Lado

MORF – **Morphology / cytology / development**
Key note speaker: I. Kalyanasundaram

METH – **Methods**
Key note speaker: D. W. Mitchell

TREN – **New trends in biosystematics and phylogenetics**
Key note speaker: D. Miller

COLL – **Collections and organisations**
Key note speaker: J. Rammeloo

Abstracts

Abstracts are in alphabetical sequence following the names of the authors of lectures and posters (if multi–authored: presenting author of a lecture, if known, in **bold**).

[Lecture – ECOL]

G. ADAMONYTE

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Myxomycete distribution patterns in anthropogenized biotopes

D 92 935

The situation of myxomycetes in anthropogenized biotopes and their response to technogenic impact is still investigated insufficiently.

In the present study, myxomycete species diversity and distribution patterns were investigated in deciduous forests in the vicinity of Lifosa enterprise of phosphate fertilizers in Kedainiai, central Lithuania. The first product of the enterprise was obtained in 1963. The main emissions are NH_3, HF SO_2, H_2SO_4, NO_x. Hard pollutants emitted from the chimneys make about 140 t/year.

The myxomycete material was collected in 1998–2001 in seven permanent plots (1000 m^2 each) located at various distances from the enterprise, the closest one situated in 0.6 km and the most distant in 14.8 km. All plots were established in 60–80 years old seminatural *Fraxinus excelsior* dominated forests of various degree of management.

In total over 1300 records of myxomycetes were obtained, including 246 those from 233 moist chambers. The material represented 110 species and varieties belonging to 31 genera.

A total species diversity (SD) and abundance (A) of myxomycetes were lower in plots situated closer to the enterprise, with the exception of the nearest plot, which was the most humid and richest in rough wood debris.

SD and A of myxomycetes collected in field from the ground (lignicolous and foliicolous species) were also lower approaching the enterprise. However, these numbers were significantly higher in poorly managed plots with larger amounts of the available rough wood debris, even if the plots were close to the emission source. No strict correlation between the distribution of lignicolous and foliicolous myxomycete SD and A in different plots and levels of heavy metals (Pb, Ni, Cd, Cr, Cu, Zn) was found, except for the negative relationship with arsenic. A tendency of increasing SD and A as pH values decreased was traced. It is possible, that SD and A followed gradients not of pH but of such factors as food, humidity, or other not estimated ones. A weak positive correlation was observed between SD and A of foliicolous myxomycetes and phosphorus level in soil. SD and A of corticolous myxomycetes were higher approaching the enterprise, presumably following the rise of tree bark eutrophication caused by emissions of P and N compounds.

The obtained data suggests that myxomycetes are sensitive to technogenic impact, but negative effect of some of its elements may be buffered by favourable determinants, such as substrate availability.

[Poster – FLOR 2]

E. Beltrán [1], **C. Lado** [2], **E. González** [1] & **J. Barrera** [1]

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Myxomycetes diversity of the laurelforest from Garajonay National Park (Canary Islands, Spain)

B 92 936

One of the most important problems to resolve in the new millennium is to stop the general environmental damage and biodiversity loss. Fortunately there are more and more countries worried about this problem. The Canary Islands are a very good European example of the conservation effort because of their large, endemic, vascular flora and richness in unspoilt natural habitats. Around 44 % of the territory of the archipelago is protected by laws, and this includes 145 protected natural areas, with four National Parks and three Biosphere Reserves.

The overall objectives of this project are as follows:

- to compile an inventory of the Myxomycetes biota of the National Park of Garajonay;
- to find out their relationships with the higher plant communities with which they are associated;
- to do a chorological and relative abundance analysis of the species according their habitats;
- to make a biogeographic analysis of the taxa inventoried.

In order to assure better monitoring, the Park's surface (4.000 Ha) was divided into 66 squares of 1 km per side, and at least one locality was selected in each one. However in several of them more than one sampling was carried out due to the ecosystem richness of the area. All types of biotic and abiotic data were taken, and the exact geographic location was fixed by UTM coordinates, found by GPS. There have been 71 samplings done so far and the results have been used as base data to elaborate distribution maps. Up to the present time, only three species of Myxomycetes had been recorded in the literature for the National Park of Garajonay. In this study about 600 field collections have been made (all kept at the TFC Mic., and Ma–Fungi, Herbaria). The type of plant community and substrate of Myxomycetes are indicated, being numerically important the lignicolous and foliicolous species. At the moment around 60 species have been identified, 12 of them are new records for the Canaries, and a very important number are being reported for the first time for La Gomera Island since Myxomycetes studies have not been done there before. For occurrence and distribution of the species, diversity and density maps are given, and some biogeographic relationships have been suggested in an attempt to find out the origin of the Myxomycetes biota of the Canary Islands.

This research was supported by the Spanish Government by means of the grant (ULL–MMA Ref. 1802069932): Evaluación de la biota criptogámica no vascular (Hongos, Líquenes y Briófitos) del Parque Nacional de Garajonay (La Gomera, Islas Canarias).

[Lecture – FLOR 1]

D. R. Black [1], S. L. Stephenson [2] & C. A. Pearce [3]

[1] Ohio University, Dept. of Environmental and Plant Biology, Athens, OH 45701 U.S.A.
[2] Fairmont State College, Dept. of Biology, Fairmont, WV 26554 U.S.A.
[3] Australian Tropical Mycology Research Centre, PO Box 312, Kuranda 4872, Queensland, Australia.

Myxomycetes associated with the aerial litter microhabitat in tropical forests of northern Queensland, Australia

One surprising result from studies carried out in Neotropical moist forests over the past four years is that myxomycete biodiversity seems to be greatest in microhabitats located above the ground, whereas in temperate and boreal forests it is greatest in microhabitats associated with the forest floor. Myxomycetes appear to be organisms adapted to highly fluctuating conditions of environmental moisture, but continuously high moisture levels apparently do not favor their growth and development. In addition to their apparent displacement from forest floor (relatively moist) to aerial (relatively drier) microhabitats, the majority of the myxomycetes encountered in Neotropical moist forests are characterized by a phaneroplasmodium, which is robust, can achieve considerable size in some species, and appears to tolerate the two extremes of the moisture gradient better than the other types of plasmodia found in myxomycetes. The objective of the present study, which is still ongoing, is to investigate the quantitative ecology and distributional relationships of myxomycetes associated with aerial litter microhabitats in tropical forests of northern Queensland, Australia. More than 90% of moist chamber cultures prepared with samples of aerial litter collected at (1) the Australian Canopy Crane Facility (16° 17' S, 145° 29' E) near Cape Tribulation and (2) Butcher's Creek (17° 24' S, 145° 44' E), a study site that belongs to the Australian Tropical Mycology Research Centre, yielded some evidence (either plasmodia or fruiting bodies) of myxomycetes. *Didymium squamulosum* was the single most abundant species, with *Physarum compressum* and *Physarum pusillum* also important. All three of these are among the more characteristic myxomycetes associated with aerial litter in Neotropical forests, which at least suggests that the aerial litter microhabitat may support compositionally similar assemblages of species in tropical forests throughout the world. (Supported in part by a grant [DEB–9705464] from the National Science Foundation of the United States.)

[Poster – FLOR 1]

M. Camino Vilaro[1] & U. Eliasson[2]

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[2] Botanical Institute, Göteborg University, Box 461, SE 405 30 Göteborg, Sweden.

Biodiversity of Myxomycetes in the Ecological Reserve "Alturas de Banao", Sancti Spíritus, Cuba

The Ecological Reserve "Alturas de Banao" covers an area of 3024 ha of the Alturas de Sancti Spíritus region in the Macizo Guamuahaya mountain chain in central Cuba. The diversity of vegetation, including montane rain forest (more than 660 m above sea level), evergreen mesophyll forest (500 – 600 m above sea level) and semideciduous mesophyll forest (200 – 500 m above sea level), favours development of different species of Myxomycetes.

Annual precipitation in the area ranges from 1700 to 2000 mm, and mean annual temperature from 22°C to 26°C (although this changes with altitude). Relative humidity varies from 81% (March – April) to 90% (October – November).

The present work lists Myxomycetes collected in "Alturas de Banao" during expeditions by specialists from the National Botanic Garden of Cuba. Sporadic visits were made before 1997, more systematic expeditions were made in subsequent years through the support by the UK Darwin Initiative. The collections comprise 33 species of 17 genera and 6 families. Nine of these species, *Cribraria violacea*, *Diderma hemisphaericum*, *Didymium clavus*, *Physarum bogoriense*, *Physarum melleum*, *Physarum nucleatum*, *Physarum nutans*, *Physarum pusillum* and *Physarum viride*, are new records. *Hemitrichia calyculata*, *Hemitrichia serpula*, *Arcyria denudata* and *Metatrichia vesparium* were the commonest species. The most frequent substratum was decomposing wood.

[Poster – FLOR 1]

M. Camino Vilaró [1] & G. Moreno Horcajada [2]

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[2] Universidad Alcalá de Henares, Dpto. Biologia Vegetal, 28871 Alcalá de Henares, Madrid, Spain.

The family Stemonitaceae in Cuba: current state of studies

The first studies on the family Stemonitaceae in Cuba date from the first half of the 19th century with the recording of two species by Montagne (1845). Some years later, Berkeley (1869), Massee (1892) and Lister (1894) carried out further work. Farr (1976) proposed in her revision a total of four species: *Comatricha elegans*, *Comatricha typhoides*, *Stemonitis fusca* and *Stemonitis splendens*.

The author of this work started studying Myxomycetes of Cuba in 1987 using material collected during several expeditions. These collections are in HAJB (National Botanic Garden Herbarium). Samples from the herbaria of IA and NY were also studied.

The main morphological features analyzed were: **sporocarp**: shape, colour, size and disposition; **stipe**: colour, size and structure; **peridium**: presence/absence; **hypothallus**: colour and disposition; **columella**: shape; **capillitium**: presence/absence of membranous expansions and/or characteristics of spine–like free ends; **spores**: colour, dimensions and ornamentation.

As a result of these studies, *Stemonitis flavogenita*, *Stemonitis herbatica*, *Stemonitis pallida* and *Lamproderma arcyrionema* were reported as new records for Cuba, the last genus was also reported as new to Cuba, and the taxa *Stemonitis axifera* and *Comatricha longa* were rediscovered (Camino, 1998). *Lamproderma scintillans* and *Stemonitis smithii* are also recent new country records. The present status of the Stemonitaceae in Cuba comprises 12 species disposed thus: *Comatricha* (3), *Lamproderma* (2) and *Stemonitis* (7). Descriptions of species, an identification key and notes on distribution are presented.

[Lecture – MORF]

A. Castillo, C. Illana, G. Moreno, A. Sanchez & H. Singer

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Spore ornamentation of myxomycetes by SEM: a review

The use of the SEM in the study of the sporophores of the Myxomycetes has been proved to be very interesting for the knowledge of its ultrastructure, as in the case, of the capillitium (Ellis & *al.* 1973; McHugh & *al.* 2000) or of the spores (Scheetz & Alexopoulos 1971, 1976). It has also been used to show differences between species as well as to clarify concrete aspects of species critics or very similar (Rammeloo 1975a; Castillo & *al.* 1997).

The study with SEM of the spores and the attempt to establish a terminology and types of spore ornamentation have been approached by several authors with different results (Schoknecht & Small 1972; Rammeloo 1974, 1975b; Hatano 1986).

Due to the increase of works with SEM to show the spore ornamentation, we have observed patterns of ornamentation not described until now. For this reason we think it is necessary a review of the terminology proposed by Rammeloo (1974), should be which it is updated and increased.

According to this terminology and based on other palinologic works (Saez 1978; Blackmore & *al.* 1992) new terms of the sculptural elements are proposed. Also the pattern of ornamentation are related to the species in which they appear, starting our own facts and the iconographies already published by other authors.

[Lecture – FLOR 1]

N. D. Cavender, J. C. Cavender [1], J. C. Landolt [2], S. L. Stephenson [3] & E. M. Vadell [4]

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Comparison of cellular slime mold populations on three Caribbean islands

Populations of cellular slime molds from Puerto Rico, St. John, V.I. and San Salvador, Bahamas were compared. These islands differ in size as well as area of forest habitats. The island populations in turn were compared to those of the Central American forest of Tikal, Guatemala.

Our objective was to determine what effects area and insular environment have on CSM diversity. We were also interested in finding examples of CSM speciation in the Caribbean. Two endemics were found: *Polysphondylium luridum* from Puerto Rico and St. John and *P. equisetoides* from San Salvador. The latter species is described as part of this presentation.

[Lecture – TREN]

J. Clark

University of Kentucky, Department of Biology, Lexington, KY, U.S.A.

Myxomycete genetics and taxonomy

About 45 years ago C.J. Alexopoulos started his program on the experimental approaches to myxomycete taxonomy and one of his students, O.R. Rollins, studying *Didymium iridis* initiated the modern era of myxomycete genetics and its application to taxonomy. As one of Ray's students at Berkeley, I was involved in some of his systematic studies but my major interest was in the genetic of plasmodial incompatibility, senescence and other complex life cycle aspects of the slime molds which were opened up to study by their heterothallic mating system. I returned to the genetics of taxonomy due to a combination of factors: the death of Ray Collins from cancer (and my inheritance of his culture collection), a temporary slow down in my research (due to a chronic respiratory problem), and the start of my association with Steve Stephenson (a random request for *Didymium* sporangia in the MSA Inoculum). Thus, a large culture collection, a new start and a source of new material allowed me to undertake the type of species and understand what this tells us about their systematic relationships. These studies, by me, my colleagues (S. Stephenson, E. Haskins, J. Landolt, M. Schnittler), and students (N. El Hage, B. Irawan) on *Didymium iridis*, *D. megalosporum*, *D. ovoideum*, *D. squamulosum*, *Physarum compressum*, *P. melleum*, *P. pusillum*, *Echinostelium minutum*, *E. coelocephalum*, *Badhamia gracilis*, *Arcyria cinerea* and other species have produced a body of information which I consider highly relevant to the taxonomy of this group. In general, the myxomycetes consist of morphospecies complexes made up of regional allopatric and sympatric biological species and numerous local apomictic clonal lines, all of which have overlapping morphological variations.

The major points to be derived from these studies are: 1. rare species, which will most likely be based on a restricted apomictic line, should be described only after a long careful study of sufficient material, and 2. some commonly accepted morphospecies are only morphological types which can be found within a single biological species.

[Poster – TREN]

J. Clark [1] & E. Haskins [2]

[1] Department of Biology, University of Kentucky, Lexington, KY, U.S.A.
[2] Department of Biology, University of Washington, Seattle, Washington, U.S.A.

Reproductive systems of *Comatricha laxa* and *Lamproderma arcyrionema*

Four cultures of the myxomycete *Comatricha laxa* were isolated from cactus detritus collected in Arizona. All four isolates were heterothallic and belong to a single biological species. However, three of the isolates produced myxamoebal clones which were all of the same mating type, and thus display a modified heterothallic system in which the diploid plasmodium segregates out only a single mating type in their spores. A single isolate of *Lamproderma arcyrionema* was also cultured, for the first time, and found to be non–heterothallic.

Morphological studies indicated that the considerable sporotheca shape variations described for *C. laxa* are found within a single biological species and appear to be due mainly to environmental effects.

[Poster – TREN]

J. CLARK [1], E. HASKINS [2] & S. L. STEPHENSON [3]

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[3] Department of Biology, Fairmont State college, Fairmont, West Virginia, U.S.A.

Biosystematics of *Badhamia gracilis*

Sixty–four isolates which conformed to the general morphological description of *Badhamia gracilis* were isolated from several arid regions in southwestern USA, northern Mexico, Puerto Rico and the Canary Islands. These isolates were then subjected to a biosystematic study involving reproductive systems, culture characteristics and morphology.

Five of the isolates were heterothallic and were divided into two seperate biological species with multiple allelic mating sytems: A1 consisting of three isolates (Arz 4, Arz 5, Arz 6) displaying four alleles; and A2 consisting of two isolates (NM 3, NM 4) also displaying four alleles. The remaining 59 isolates were nonheterothallic and presumably apomictic. All of the isolates had similar culture characteristics in that they had white (rarely with a yellowish tinge) rapidly growing plasmodia which sporulated at a relatively small size. While all of the isolates generally conformed to the standard species description, there were several variations from the norm that occurred at a high frequency. The sporangial head was often laterally flattened instead of globose or ovate, the spores generally averaged 10 µm instead of 14 µm in diameter, and the capillitia often appeared physaroid instead of badhamoid. This study indicates that *Badhamia gracilis* is probably a widespread species complex consisting of a number of local sexual populations and numerous asexual clones which are adapted to arid conditions.

[Poster – TREN]

J. Clark[1], M. Schnittler[2] & S. L. Stephenson[3]

[1] Department of Biology, University of Kentucky, Lexington, KY, U.S.A.
[2] Botanical Institute and Botanical Garden, Ernst–Moritz–Arndt University Greifswald, Grimmer Str. 88, 17487 Greifswald, Germany.
[3] Department of Biology, Fairmont State College, Fairmont, West Virginia, U.S.A.

Biosystematics of *Arcyria cinerea*

D 92 [illegible]

Seven isolates of the small brownish ochraceaous form and six isolates of the small longstalked pallid form of *Arcyria cinerea* were cultured on agar and their reproductive system determined. Three of the small pallid forms from Ecuador were heterothallic and belonged to two sympatric biological sibling species: A1 containing the Ecu 3 isolate and A2 containing the Ecu 1 and Ecu 2 isolates. The other ten isolates were nonheterothallic. Plasmodial fusion studies indicated that these ten nonheterothallic isolates were divided into nine genetically different clonal lines, that also did not fuse with the three heterothallic isolates. Morphological examination of these isolates indicated that several of the small brownish ochraceous isolates matched the *Arcyria pomiformis* description with the exception that they lacked inner calyculus papillae. Also, both of these forms (ochraceous and pallid) were stable through several generations of culture. Since in the study, the brownish ochraceous from appears to be as close to *A. pomiformis* as it is to the large grey form of *A. cinerea*, further studies including more isolates are needed to unravel this complex.

[Poster – FLOR 2]

M. de Haan[1] & S. De Pauw[2]

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A study of the genus *Oligonema* in Belgium

The genus *Oligonema* was published in 1875 by Rostafinski. It is situated in the family *Trichiaceae* of the Order *Tricheales*. According to the literature only 5 species are recognized, *O. aurantium* Nann.–Bremek., *O. flavidium* (Peck) Peck, *O. fulvum* Morgan, *O. oedonema* Yu Li, Shuang L. Chen & H.Z. Li and *O. schweinitzii* (Berk.) Martin. They have all been recorded in Belgium, except *O. oedonema* a species reported from China. The Myxomycetes study group of the Koninklijke Antwerpse Mycologische Kring took this as a good opportunity to make a more extended study of the genus *Oligonema*.

Detailed decriptions were made of about thirty specimens from herbaria of the National Botanic Garden (BR) and the University of Ghent (GENT) which contain the largest collections of Myxomycetes in Belgium. An important contribution also came from private herbaria.

From every species a synthesis was made of the most typical specimens, which lists the most characteristic traits. The deviating specimens were mentioned seperately. The summerizing descriptions of each species, or typeforms as we call them, were used to make a definition of the genus and a dichotomous key to the species. Of the most typical specimens SEM–pictures were taken of the peridium innerside, the capillitium and the spores.

After comparison of some of the the Belgian collections of *O. aurantium* with SEM results of the type collection from the Netherlands it became clear that capillitium and spores did not resemble each other at all. These collections will be described seperately, either as a new species *Oligonema intermedia* nom. prov. or a variety of *O. aurantium* or *O. schweinitzii*. Which will be published in the next edition of Sterbeeckia (2003). The name "intermedia" is chosen because it can be situated between *O. aurantium* and *O. schweinitzii*, but with its own distinct features. One other collection also previously named *O. aurantium* is indeed close to it, but has been described as *Oligonema sp.* because there are still enough differences.

A description of the specific habitat in which the members of the genus develope is included in the study.

[Poster – ECOL 3]

L. DE HOLANDA CAVALCANTI[1] & M. MOBIN[2]

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[2] Centro Federal de Educação Tecnológica do Piauí, Praça da liberdade 1597 Centro, 64000–040, Teresina, PI, Brasil.

Myxomycetes associated with palm trees in the Sete Cidades National Park, Piauí, Brazil

Palm trees (Arecaceae) are specialized ecosystems which hosts a wide variety of organisms, including Myxomycetes. *Copernicia prunifera* (Miller) H. E. Moore, *Mauritia flexuosa* L. f. and *Astrocaryum vulgare* Mart. were selected for study the incidence and diversity of myxomycetes in savanna, riverside forest and secondary forest at the Sete Cidades National Park (4° 5' – 4° 15' S and 41° 30' – 41° 40' W, 480m alt., 6.221,48 ha), northeastern Brazil. Fructifications were searched on dead and living stipitis, leaves and inflorescences. The samples were herborized and included in the Herbarium UFP (Department of Botany, Federal University of Pernambuco). Myxomycetes were found in both dry and rainy season and the high diversity of taxa was verified in the raining period. A high incidence of myxomycetes (70–100%) was registered, with diversity index of 5.23 (*M. flexuosa*, *A. vulgare*, secondary forest), 5.05 (*C. prunifera*, *A. vulgare*, savanna) and 3.49 (*A. vulgare*, riverside forest). The largest occurrence was registered on the spathe, followed by the petiole and leave sheat, being rare on the alive stipitis and fruits. A total of 45 species were identified, pertaining to the families Ceratiomyxaceae (*Ceratiomyxa* 1sp.), Cribrariaceae (*Cribraria* 3sp.), Clastodermataceae (*Clastoderma* 1sp.), Trichiaceae (*Arcyria* 6sp., *Hemitrichia* 2sp., *Metatrichia* 1sp., *Perichaena* 1sp., *Trichia*, 1sp.), Stemonitaceae (*Comatricha* 7sp., *Macbrideola*, 1sp, *Stemonitis* 7sp.), Physaraceae (*Craterium* 2sp., *Physarella* 1sp., *Physarum*, 7sp.) and Didymiaceae (*Diachea* 2sp, *Didymium* 3sp.) were registered. *Arcyria cinerea* (Bull.) Pers., *A. denudata* (L.) Wetts., *Hemitrichia calyculata* (Speg.) Farr, *H. serpula* (Scop.) Rost., *Metatrichia vesparium* (Batsch) Nann.–Brem., *Physarum nucleatum* Pers. and *Stemonitis splendens* Rost. were the most frequent species. Comments and geographical distribution of these species are presented.

This research was supported by the Conselho Nacional de Desenvolvimento Cientifico e Tecnologico – CNPq, Coordenação de Aperfeiçoamento de Pessoal do Ensino Superior – CAPES and Fundação de Amparo à Ciência e Tecnologia de Pernambuco – FACEPE.

[Poster – FLOR 2]

A. Drozdowicz

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Myxomycetes in the Botanic Garden of the Jagiellonian University in Cracow

The Botanic Garden in Cracow, founded in 1783, has been a "living laboratory" and "green museum" for botanists. Also for mycologists it is interesting for its specific sites being created in glasshouses and in open, ground collections. But, only a few of them carried out investigations of Myxomycetes in botanical gardens, for example in Wroclaw (Schroeter 1873 and Stojanowska 1992), or in Lwów (now Lviv – Krzemieniewska 1937). In 1882 M. Raciborski collected Myxomycetes in the vicinity of Kraków, and in the Botanical Garden too. From June to October he found here 12 species, in this *Rostafinskia elegans* Racib.

The occurrence of Myxomycetes in the Botanical Garden in Cracow has been investigated since 1984, however sporadically. At that time it was found in 1989, for example *Stemonitis axifera* (Bull.) Macbr. on decayed part of trunk of living oak *Quercus bicolor* Willd. In the next year, in the same locality, *Ceratiomyxa fruticulosa* (Müll) Macbr. was noted. In 1991 the trees in the Botanical Garden underwent conservation and protection measures with the use of fungicides, accompanied by cleaning the trunks, and the removal of dead parts. In effect, the occurrence of Myxomycetes became limited.

The further observations carried out in glasshouses gave more interesting foundings; for example, in 1998 a mass occurrence of *Fuligo septica* (L.) var. *septica* Wiggers, and in 2001 *Fuligo septica* var. *rufa* (Pers.) R. E. Fr. gave a clue for more detailed investigations. The remaining stumps of trees: *Populus robusta* Schneid., *Celtis occidentalis* L. and *Ulmus glabra* Huds. have been under continuous observation. Alongside with the decaying of the wood and the stumps disintegration new species of Myxomycetes have appeared. In glasshouses a specific site create wooden props for epiphytes and pots.

Today, in the Botanical Garden in Kraków 16 species of Myxomycetes were found, in this only 5 species noted by Raciborski. During the vegetation season in 2001 the samples of bark and fragments of various substrata from the ground and glasshouse were gathered for further cultivation. Hitherto, only a few sporangia of *Comatricha nigra* and some unspecific plasmodia were grown in the laboratory.

Botanical gardens, being often a part of big cities, create an opportunity not only to maintain the rich plant flora but are also an enclave for other group of organisms, in this Myxomycetes species diversity, with hope to recording too much taxon in the future, than in this preliminary study.

[Poster – FLOR 2]

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Myxomycetes in Bohemian Karst and Hebeny Mts.

Data on species composition and ecology of Myxomycetes are presented for two relatively different localities near Prague – three National Reserves in the Bohemian Karst and the northern part of Hebeny Mountains.

Methods: During a period of three years, all localities were investigated intensively (approximately once a month or more often in the season). Common and easily recognised myxomycete species were collected only occasionally, but rare species and species not easy to recognise in the field were always collected. In addition to field collections, bark of living trees, twigs and dead leaves were cultivated in moist chambers. Specimens from the localities studied, deposited in the Mycological Herbarium of the National Museum in Prague (PRM), were also included in the study.

Results: In total 813 specimens were studied. Out of these, 340 were collected in the field, 362 were harvested from moist chamber cultures and 99 were found in the Mycological Herbarium of the National Museum in Prague (PRM). The collections comprised ninety-five species of Myxomycetes belonging to 29 genera, including 18 species new to the Czech Republic[1] and one seemingly undescribed (*Didymium cf. squamulosum*). The species were identified according to Martin and Alexopoulos (1969), Lado and Pando (1997), Nannenga-Bremekamp (1991), Neubert *et al.* (1993, 1995) and Ing (1999). The abundance was estimated with a simple scale proposed by Stephenson *et al.* (1993), based on the proportion of records for one species on all fructifications recorded in the survey: R (rare <0.5%), O (occasional 0.5 – 1.5%), C (common 1.5 – 3%), A (abundant >3%).

Discussion: From the whole Czech Republic, 204 Myxomycete species have been reported (Dvoáková 1999b). The 95 species found in the area studied (about 40 sq km) indicate a rich offer of substrates for Myxomycetes present here as well as low research intensity in the rest of the country. Also the average number of species per genus (3.27) shows a relatively high species diversity. The degree of species classified as rare (collected 1–2 times) is relatively high – 40%.

1 – *Arcyria major* (G. Lister) Ing, *Calomyxa metallica* (Berk.) Nieuwl., *Badhamia dubia* Nann.-Bremek., *Cribraria persoonii* Nann.-Bremek., *Diderma cingulatum* Nann.-Bremek., *Echinostelium apitectum* Whitney, *Fuligo leviderma* Neubert, Nowotny et K. Baumann, *Hemitrichia calyculata* (Speg.) Farr, *Lamproderma scintillans* (Berk. et Br.) Morgan, *Licea biforis* Morgan, *Licea kleistobolus* G.W. Martin, *Licea minima* Fr., *Licea operculata* (Wingate) G.W. Martin, *Licea parasitica* (Zukal) G.W. Martin, *Paradiacheopsis solitaria* (Nann.-Bremek.) Nann.-Bremek., *Physarum decipiens* M.A. Curtis, *Stemonitopsis subcaespitosa* (Peck) Nann.-Bremek., *Trichia munda* (Lister) Meylan.

There was a higher number of species recorded in the Bohemian Karst (84 species) than in the Hebeny Mts. (68 species). This is probably due to a different and richer vegetation composition in Nature Reserves caused by the limestone base in the Bohemian Karst.

The occurrence of the Myxomycete orders of *Physarales* and *Liceales* during the year was more or less concentrated to one relatively short period of time during the summer season (the highest peak in July). Species of *Trichiales* (mostly xylophilous) were typical of the autumn aspect and otherwise fructified in a small quantity during the whole year.

Moist chamber cultures. – 250 chambers, prepared with samples of bark and litter, yielded 33 species representing 19 genera of Myxomycetes. Only *73 %* of the moist chambers yielded Myxomycete fructifications. Among the most favourable substrates for Myxomycetes in moist chambers were *Acer* sp(p)., *Aesculus hippocastanum, Betula pendula*, *Crataegus* sp. and *Quercus* sp(p). A quite specific Myxomycete flora occurred on *Juniperus communis, Malus domestica* and *Sambucus nigra.*

[Lecture – FLOR 1]

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Myxomycetes of Hawaii

D 92 950

The isolated geographical position, the long chain of islands of different geological ages, and the wide range of habitats on individual islands of the Hawaiian archipelago have given rise to outstanding examples of diversification and adaptive radiation among plants as well as animals. Although the endemicity of vascular plants is high (about 89% for indigenous angiosperms) as a result of adaptive radiation, there are no examples of similar evolutionary flexibility in lower cryptogams. About 105 species of Myxomycetes have been confirmed and identified to species in Hawaii. An additional one or two may represent species new to science. In contrast to, for example, angiosperms, it is not possible to trace any biogeographical connections based on Myxomycetes due to the wide or ubiquitous distribution of most species.

Among the commonest and most conspicuous species in rainforest–like habitats in Hawaii are *Arcyria cinerea, A. denudata, Diderma effusum, Hemitrichia calyculata, H. serpula, Perichaena chrysosperma, P. depressa, Physarella oblonga, Physarum melleum, P. nucleatum, P. stellatum, P. tenerum, Stemonitis fusca, S. smithii* and *Tubifera microsperma*. Decaying leaves of palms or other large monocots on the ground often harbour several species. Stalks and tissue near the mid–vein of large decaying palm leaves may become very hard and wood–like in external texture and represent a substratum for species normally growing on dead wood, for example *Stemonitis fusca*. Sheaths of dead leaves form natural moist chambers where several species may be found. Species may vary considerably in frequency from one time to another even if the conditions appear to be more or less the same.

Dead tissue of various introduced succulents such as *Euphorbia, Opuntia* and *Stapelia* harbours special myxomycete species. *Badhamia gracilis* may cover many cm^2 on decaying cladodia of *Opuntia* and even develop large numbers of sporocarps in the interior of the cladodium if the outer tissues are damaged. Other species characteristic of this substratum are, for example, *Fuligo cinerea, Perichaena depressa, P. vermicularis* and *Physarum pusillum*.

Two previous species records from Hawaii have been revised. What was reported (Eliasson 1991) as *Licea clarkii* has been found to be *L. rufocuprea* in the revised description by Mitchell (2002). The specimen reported as a simple–sporangiate form of *Physarum polycephalum* appears to be a form of *P. pezizoideum* with contorted sporocarps. *Physarum polycephalum* has not yet been confirmed from Hawaii.

[Poster – FLOR 2]

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Myxomycetes of Mezit Stream valley, Turkey

3 31 954

The field trips were organized to discover the myxomycetes existence and distrubution in the selected area of Mezit valley which is located on the border lines of the Bursa–Bilecek–Eskisehir provinces of Turkey. This region has a specific macro–microclimate and vegetation due to Mezit Stream. As a result of descriptive and determinative studies on the collected myxomycete specimens, we have identified 33 taxa which belong to 11 different genera of myxomycetes.

[Lecture – TREN]

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The myxomycete genus *Schenella*: morphological and molecular evidence for the gasteromycete genus *Pyrenogaster*

The identification of *Schenella simplex* as a myxomycete was so doubtful that T.H. Macbride, who described the species in 1911, omitted it from his 1922 monograph. In the 1934 monograph by Macbride and G.W. Martin, *Schenella* was again included. After restudy of the type, Martin in 1962 validated the genus and described a second species, *S. microspora*. *Schenella* has been a taxonomic puzzle ever since Macbride placed it in the Dianemaceae, Hagelstein in the Amaurochaetaceae, Martin in the Stemonitaceae, and Nannenga–Bremekamp separated it into an independent family, the Schenellaceae. In 1985 Rammeloo examined the type specimen of *S. simplex* with SEM, expressing doubt that the taxon was even a myxomycete because the spores possessed a pore similar to that of some taxa in the fungal order Agaricales. Morphological evidence based on light and scanning microscopy on the types of both *Schenella* species and 20 collections from Mexico provides evidence that this taxon is a gasteromycete and probably *Pyrenogaster atrogleba*. The fruiting bodies are composed of subcylindrical compartments arranged into a palisade filled with capillitium and spores originally perceived as myxomycete sporangia. Morphological evidence shows that the peridium is cellular along with hyphal elements with clamp connections, the capillitial threads sometimes appear septate with clamp connections, and the spores have an elliptical shape, the surface roughened with flattened, disclike areas, and a circular, depressed pore or scar at one end. Some spores measure 3 to 4 µm in diameter, smaller than any known myxomycete species. Molecular evidence was based on total nucleic acids isolated from a specimen collected in Mexico and identified as *Schenella simplex* by Arturo–Torres. Oligonucleotide primer pairs designed to amplify myxomycete nuclear or mitochondrial small subunit ribosomal DNAs were used in the polymerase chain reaction (PCR). While no amplification product was obtained for the mitochondrial primer pair, an amplification product consistent with a fungal nuclear template, but not consistent with a mitochondrial or bacterial template, was obtained with the nuclear primer pair. Sequence analysis of the amplification product obtained with the nuclear primer pair revealed a sequence similar to those found in an anciently diverged, monophyletic group of fungi which include *Geastrum*, *Gomphus*, and *Ramaria*, but quite different from sequences from myxomycetes. A primer pair designed to amplify fungal mitochondrial small subunit ribosomal DNA sequences with PCR was used to amplify sequences from *Schenella* nucleic acids. An amplification product of the size predicted for fungal mitochondrial rDNA sequences was obtained. Sequence analysis of the mitochondrial amplification product revealed sequences similar to the mitochondrial DNA of the same monophyletic fungal group. Phylogenetic analysis of both nuclear and mitochondrial DNA sequences amplified from *Schenella* nucleic acids indicates that *Schenella* should be grouped with these fungi and is most closely related to *Geastrum*.

[Lecture – FLOR 1]

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Plant diversity in the Mexican Neotropics: opportunities for studies of ecological specificity and speciation in myxomycetes

The Neotropics, one of the most biogeographically diverse regions on Earth, include countries that themselves are considered as megadiverse. Among these countries, Mexico stands out because of its geographic position between the Neotropic and the Nearctic realms, which allows the overlap of plants and animals with austral and boreal origins. In addition, other geographic and historical factors, such as topography, the oceanic influence and the geographic isolation of some areas, have contributed to the high biodiversity of this country. More than 22,000 vascular plant species occur in Mexico, many of them Neotropical in origin or endemics with their origin and diversification in Mexico. In contrast to its high plant biodiversity, only 265 species of myxomycetes have been recorded from Mexico, although in the last few years remarkable progress has been made in the study of these organisms. As a consequence of the broad spectrum of substrates and microenvironments associated with high plant diversity, we believe that myxomycetes have had a unique opportunity for ecological specialization and speciation. As we study new ecosystems, undescribed species or new records for Mexico are collected, some of them occurring in microhabitats widely occupied by myxomycetes but others seemingly linked to particular ecological conditions. Some of our previous data from the Neotropics already points to this conclusion. For example, two previously unknown ecological groups (the succulenticolous and the floricolous myxomycetes) have been described, and several others, such as those growing on tropical dry fruits (*Ceratiomyxa sphaerosperma*), moss beds on rocks in the tropics (*Physarum alvoradianum* and *Diderma* aff. *rugosum*), or on leathery leaves with densely hairy lower surfaces (*Calonema foliicola* and several undescribed members of the Trichiaceae), are still under study. Although many Mexican myxomycetes have a pantropical distribution (e.g., *Craterium paraguayense*, *Diachea silvaepluvialis*, *Metatrichia horrida*, and *Physarum javanicum*) or appear to be restricted largely to the Neotropics (e.g., *Diderma miniatum*, *Diderma rimosum* and *Physarum alvoradianum*), more new species known only from Mexico or its neighbours are being described (e.g., *Cribraria fragilis*, *Didymium mexicanum*, *Physarum tropicale* and *Diderma acanthosporum*). Some others of Mexican origin but with distributions extending to other continents (e.g., *Cribraria zonatispora*), occur only on introduced Mexican plants. All of these data seem to indicate that, as has been reported for other groups, Mexican environments may have provided the ecological conditions for a strong speciation process. The simple morphology of the myxomycetes is perhaps masking the effect of this process, which we will understand only after more intensive fieldwork and more powerful techniques of analysis are applied to systematic, ecological and biogeographical studies of this group.

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[Poster – MORF]

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Morphogenesis of the sporocarps of *Cribraria fragilis*

The morphological transformation of the plasmodium to generate myxomycete fruiting bodies (sporocarp morphogenesis) has been considered one of the most intriguing and little understood of the biological processes, but its utility as a source of taxonomic and phylogenetic evidence has been fully demonstrated (Mims, 1973; Aloxopoulos, 1973; Keller & Eliasson, 1992). This process is known only in a few species of *Cribraria*, i.e. *C. violacea* (McManus, 1966) and *C. zonatispora* (Lado *et al.*, 1999). For this reason, we chose to study *Cribraria fragilis*, a recently described species from a dry tropical forest in Mexico (Estrada–Torres *et al*, 2001). It is a succulenticolous species which grows on skeletons of columnar cacti. In new fieldwork, additional collections of the species were found on the Malintzi volcano, Tlaxcala, Mexico, growing on rotten leaves of *Agave salmiana*. Part of this substratum was collected and cultured using the moist chamber technique, for observation of sporocarp morphogenesis.

Sporocarps, in different developmental stages, were mounted in Hoyer's medium for observation by light microscopy, or fixed with FAA, dehydrated in gradually increasing concentrations of alcohol for their inclusion in resins and cut with a microtome, for more precise observation of the different structures.

Sporocarps started to appear two weeks after the moist chambers were begun. Plasmodia were hyaline with some violet granular inclusions and of the protoplasmodium type. The morphogenetic process was very similar to that of *C. zonatispora*, another succulenticolous species which grows on Mexican cacti and agaves, and is of the myxogastroid type described by Ross (1973).

In the first developmental stages, observations showed that the hypothallus was derived from a membrane. Stalk elongation and calyculus formation came next. We then observed a concentration of the violet protoplasm at the apex of the stalk, which gave rise to the sporothecae. The different developmental stages, as well as the migration of the granules contained in the sporothecae, cytoplasm fragmentation to produce the spores, and spore formation and maturation are also discussed

[Poster – FLOR 2]

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The myxomycetes of coniferous forests in the Ural Mountains (Russia)

Data on occurrence and abundance of myxomycetes are presented for a vast area of the Ural Mountains extended on more than 1500 km from North to South. This mountain ridge crosses four basic vegetation zones of Russia including the different coniferous forests with *Abies sibirica, Larix sibirica, Picea obovata, Pinus sibirica, and P. sylvestris*, and the mixed birch forest with *Betula* spp. The mixed coniferous–broad–leaved forest with *Querqus robur* and *Ulmus* spp. and the forest–steppe communities are presented in the southern part of the Ural. 183 species of myxomycetes representing 40 genera were registered with certainty. The biggest genera are *Arcyria* (12 species), *Comatricha* (9), *Cribraria* (18), *Licea* (11), *Physarum* (27), *Trichia* (14). Abundant species (more then 3% from all specimens) are *Arcyria cinerea, Ceratiomyxa fruticulosa, Comatricha nigra, Enerthenema papillatum, Physarum nutans* and *Trichia varia* from field collections and *Arcyria pomiformis, Echinostelium minutum, Paradiacheopsis fimbriata* from moist chambers cultures. The myxomycetes exhibit the highest species richness in the boreal coniferous forests – 180 species. The species number decreases from 106 species in the mezophylic coniferous forests (Picea–Abies) to 55 in the xerophytic pine–birch forests and ten species in the adjacent forest–steppe subzone. Thirty–three species of myxomycetes were recorded in the forest–tundra. Fourty species were recorded in the mixed coniferous–broad–leaved forests. The typical species for northern part of the Ural Mts. are *Mucilago crustacea* and *Trichia munda*. For the southern part of the study area the typical species are not registered, but abundance and richness of *Didymium spp.* and some other species increase progressively. *Hemitrichia serpula, H. calyculata, Physarum decipiens* are typical species for the mixed coniferous–broad–leaved forests. Some of them are rare and were found in the middle part of the Ural and, they probably are relic species of coniferous forests which covered here a vast area in the past. Composition of Myxomycetes assemblages and abundance of species decrease northwards. Species with disjunctive distribution are absent. However most species have different preferences to the natural–climate zone forming 10 groups. Only twenty species were recorded in all zones of the Ural Mountains.

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[Poster – FLOR 2]

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The myxomycetes of the Ural Mountains and its distributions in Russia

D 92 956

The Ural Mountains are characterized by the high diversity of myxomycete biota. 193 species of the myxomycetes are recorded in the Ural mountain ridge. Ten species known in Russia were registered with high abundance (> 1.5 % of occurrence) still only here (for example, *Barbeyella minutissima*). Few species inhabit both in western Siberia and in the Ural (*Paradiacheopsis cribrata, Trichia munda,* and *Licea testudinacea*). About thirteen species here are known from the European part of Russia and from the Ural mountains and never been found in Siberia (*Amaurochaeta atra, Badhamia macrocarpa, Colloderma oculatum, Comatricha longa, Craterium aureum, Cribraria languescens, C. microcarpa, Diacheopsis metallica, Diderma simplex, Didymium annelus, Echinostelium elachiston, Enteridium intermedia, Hemitrichia leiotricha, Lepidoderma tigrinum, Licea biforis, Licea castanea, Lindbladia tubulina, Paradiacheopsis solitaria, Perichaena minor, Physarum bitectum, P. compressum, P. conglomeratum, P. decipiens, P. didermoides, P. famintzinii, P. serpula, P. vernum,* and *Trichia verrucosa*). It seems this fact gives base for assumption that the Ural Mountains is one of the natural biogeographical boundary in the distribution of some myxomycete species on the Earth. This probably, can be explained by barrier effect of the Ural mountain ridge in the transference of the air mass. Prevalent western winds in this region carry great quantity of the moisture and the rainfalls are not rare here. Part of wet air transfer further toward East. Precipitations are still abundant within 50–100 km zone (Ural rain shadow). Climate becomes abruptly continental after this area, typical for the Western–Siberia plain. In result, the dark wet coniferous forests with spruce (*Abies sibirica*) and mixed coniferous–broad–leaved forests develop on the western slope and dry light pine and larch forests develop on the eastern slope. Probably this factor together with difference of macroclimate condition seems to explain many of the special features of the myxomycete assemblages on the western and eastern slopes.

This work was supported in part by grants (N 02–04–98420, 02–07–90439, 02–04–49907) from the Russian Foundation for Basic Research (RFBR) and by grant from Presidium of Russian Academy of Sciences for young scientists.

[Poster – TREN]

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A molecular phylogeny of the Myxogastrid slime molds

The true slime moulds (Myxogastridae) are a large and diverse group of organisms, of a taxonomic rank probably roughly equivalent to that of the animal kingdom, to which they appear to be very closely related. Nonetheless, there is little or no molecular data on most taxa, and their higher order systematics is poorly understood.

We are constructing a molecular phylogeny of the Myxogastridae by characterizing the widely–used phylogenetic marker, elongation factor 1–alpha, from a broadly–representative set of taxa. Sequences are being determined for a minimum of two taxa from each of the five major divisions of the group, i.e. Physarales, Stemonitales, Trichiales, Echinosteliales and Liceales.

Along with preliminary results, the choice of the species will be justified, and the advantages of the methods detailed.

[Lecture – TREN]

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Taxonomic position of *Lamproderma nigricapillitium*

Lamproderma nigricapillitium (Nannenga–Bremekamp & Bozonnet, 1989) is a nivicolous species characterised by a dense netted black capillitium with conically expanded bases, a long columella, and rather small densely minutely warted spores. The recent critical review of *L. nigricapillitium* placed it in the genus *Comatricha*, because of the capillitium not joined to the columella along its whole length and the rather early evanescent peridium. *L. nigricapillitium* fits also the description of the new genus *Meriderma*, characterized by nivicolous habitat, early fragmented peridium, and a very dark, reticulated capillitium, which is joined to the columella along most of its length. Given the lack of resolution of morphological characters, we attempt to establish the taxonomic position of *L. nigricapillitium* based on molecular data. DNA of *L. nigricapillitium* and eight representatives of the genera *Lamproderma*, *Comatricha*, *Meriderma* as well as related genera *Macbrideola* and *Enerthenema* was extracted from fresh or desiccated specimens collected in the field. A fragment of small subunit ribosomal RNA gene was amplified by PCR and sequenced directly. The obtained sequences were analysed using different phylogenetic methods and the results of these analyses are presented here.

[Poster – SYST]

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Microscopic evidence supporting the cogeneric status of *Schenella simplex* and *S. microspora*

In 1911, Thomas H. Macbride established the taxon *Schenella simplex* to elicit information from mycologists on an enigmatic undescribed species. George W. Martin described a second species, *S. microspora* in 1957. Originally, Martin believed that the taxon he described as *S. microspora*, might be an aethalioid member of the Stemonitaceae closely resembling *Amaurochaete*. Unpublished evidence by Estrada-Torres and D. Miller *et al.*, will contend that *S. simplex* is a gastroid basidiomycete synonymous with *Pyrenogaster atrogleba*. Examinations of the type of *S. microspora* were made with light microscopy (LM) and scanning electron microscopy (SEM). Light microscopic observations of *S. microspora* revealed sparingly, septate, roughened, hyphal elements, whereas studies of hyphae from *S. simplex* revealed smoother walled structures.

With SEM, the spore process ornamentation in *S. microspora*, *S. simplex* and *P. atrogleba* is remarkably similar. In this regard, it is only the smaller spores in *S. microspora* that is noteworthy. Our SEM observations do not support similarities between *S. microspora* and *Amaurochaete*. Indeed, examinations of the type *Amaurochaete ferruginea* clearly support the myxomycetous identity of this taxon.

[Poster – ECOL 3]

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Myxomycetes on decayed wood of three different vegetation types in southwest Japan

D 92 36c

The diversity and abundance of myxomycetes on decayed wood were examined in three different vegetation types at Ebino region of Kyushu, southwest Japan (ca. 31°56'N, 130°50'E). The field work was carried out in summer (20–22 July) and fall (9–11 November) in 2001. We enumerated all the visible fructifications on decayed wood over 13 cm diam. As a result, we observed 666 samples, and recognized 57 taxa of 22 genera in total. In the summer 36 taxa (14 genera) and in the fall 31 taxa (19 genera) were observed, 10 taxa (18% of all) were observed commonly in both the seasons.

(1) Evergreen oak forest (ca. 340 m alt., dominated by *Quercus gilva* Blume)
26 taxa (13 genera), containing many specimens of *Hemitrichia*, *Arcyria* and *Stemonitis*. No species of *Trichia* were observed in summer. *Cribraria cancellata* var. *fusca* and *Arcyria denudata* appeared characteristically in this vegetation.
In fall, myxomycetes decreased noticeably to 8 in number of species. 7 taxa were observed in this vegetation only.

(2) Japanese read pine forest (ca. 1100 m alt., dominated by *Pinus densiflora* Sieb. & Zucc.)
29 taxa (17 genera), containing many specimens of *Lycogala*, *Arcyria*, *Cribraria* and *Physarum*. Some species (*Colloderma robustum*, *Diderma ochraceum*, *Lepidoderma tigrinum*, *Lamproderma columbinum* etc.) occurred on mosses growing on decayed wood in fall. *Lycogala epidendrum* (s. l.) was richest in the fall. 7 taxa were observed in this vegetation only.

(3) Japanese hemlock forest (ca. 1200 m alt., dominated by *Tsuga sieboldii* Carr.)
38 taxa (19 *genera*), containing *many specimens* of *Cribraria*, *Trichia* and *Lycogala*. Some species (*Ceratiomyxa fruticulosa* var. *porioides* etc.) appeared in summer and some species (*Cribraria dictyospora*, *Trichia verrucosa*, *Trichia decipiens* etc.) occurred in the fall. 11 taxa were observed in this vegetation only.

[Lecture – ECOL 2]

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The communities of bryophytes, lichens and myxomycetes on bark of living trees in Hunan, Southern China

392 954

Bryophytes, lichens and fungi of Hunan are being co–operatively studied by the Forestry Department of Hunan Province and by the Department of Ecology and Systematics of the University of Helsinki. In September 2000 during a research period at the Badagongshan Nature Reserve at an altitude of 1300–1455 metres, a group of Finnish researchers collected material for a sociological study on bark– inhabiting slime moulds, lichens, mosses and hepatics. An overall goal of the project is to assist scientists and authorities of Hunan Province in preparing cost–effective methods for monitoring environmental quality when planning forest plantations, conservation and ecotourism.

We studied *Liriodendron chinense, Magnolia officinalis, Metasequoia glyptostroboides, Phellodendron chinense, Pterostyrax psilophylla, Sassafras tzumu,* and *Tapiscia sinensis*. For every tree species, 15 individuals were surveyed, except for *Liriodendron* with 10 samples. Collections of epiphytes were made from a one metre high cylinder around each trunk. One bark sample of southern and one of northern exposition was collected for pH measurement and to establish moist chamber cultures. Extra samples were collected to investigate physiological and anatomical features of the substrates.

At present, specimens have been identified to species, genus or family level. The pH, conductivity, water–retaining capacity and the distribution/features/numbers of lenticels, fissures and ridges of each bark were analysed

Results. Specimens of different systematic groups were found on the bark as follows:

	Taxa	Myxom.	Lichens	Mosses	Hepatics	pH
Liriodendron	49	5	27	13	4	5.9–7.3
Magnolia	26	4	18	1	3	5.8–8
Metasequoia	47	14	11	**18**	4	4.7–5.8
Phellodendron	49	8	28	8	5	5.4–7
Pterostyrax	45	6	28	8	3	5.1–7.2
Sassafras	45	**15**	23	0	7	3.9–5.4
Tapiscia	**69**	6	**33**	15	**15**	5.8–7.2

Tapiscia sinensis had the richest epiphyte flora, although it was not especially rich in myxomycetes.
Altogether 33 myxomycetes species were found, with the most acidic bark of *Sassafras tzumu* being the best substrate for myxomycetes. Many myxomycetes also appeared on *Metasequoia glyptostroboides*, which has relatively acidic bark and the highest water–holding capacity. The least favourable for myxomycetes was the most basic bark of *Magnolia officinalis* which also supported a low number of other epiphytes. Of myxomycetes, *Magnolia* yielded only members of Physaraceae.
NMS ordination of sample plots of the 100 host trees in epiphyte species space shows how the different tree species group according to the similarities in species composition, and how trees with moderately acidic bark group together, while trees with acidic bark and those with the most basic bark form groups of their own.

Conclusions. Different types of epiphyte communities develop on different tree species. A sweeping generalisation might be that bark with many lichens does not favour myxomycetes. Maybe they are sensitive to toxic lichen substances.

[Lecture – ECOL 2]

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Corticolous myxomycetes and lichens in the Botanical Garden in Helsinki, Finland: a comparison after decades of recovery from air pollution.

B 92 962

In 1974–1975 the first author made moist chamber cultivations with bark of living trees at two–week intervals for a period of 18 months. The Botanical Garden of the University of Helsinki was chosen to represent a polluted area in the centre of Helsinki where only two species of corticolous lichens were found.
At present, in 2002, the air of the area has improved. The Helsinki Metropolitan Area council follows the air quality in Helsinki and has a monitoring station situated only about 100 metres from the Botanical Garden. During the past twenty years the concentrations of sulphur dioxide and lead have clearly decreased and average concentrations of nitrogen oxides, carbon monoxide and total suspended particulates have diminished. Only ozone concentrations have increased during the last ten years. The improvement in air quality can also be seen in the return of several lichen species to the garden. The second author found 18 species of lichens now growing on tree–trunks, so the first author decided to investigate the situation concerning corticolous myxomycetes using the same methods as 28 years ago. In December 2001 and January 2002 altogether 100 bark samples were collected from 50 individual trees and incubated for four weeks, then dried and rewetted for a further three weeks. pH of the moisture in the moist chambers was measured and the chambers were surveyed periodically for myxomycetes.

Results. 28 years ago the pH of the substrates varied from 2 to 9, it was now more stable varying from 3 to 7. In 1974–1975 only six species of myxomycetes emerged on the barks of living trees of the Botanical Garden, whereas in the moist chambers made with bark samples from a virgin forest about 25 km north of Helsinki 16 species were harvested. Now, 28 years later, 14 species were identified from the Botanical Garden from a considerably smaller number of moist chambers (400 in 1974–1975, 100 in 2001–2002). So the number of corticolous myxomycete species in the Botanical Garden has more than doubled during the past 28 years. The most abundant species 28 years ago was the toxitolerant *Paradiacheopsis fimbriata*. Now the most abundant species is *Arcyria pomiformis*.

Conclusions. Athough myxomycetes can grow in a wide range of pH, they seem to benefit from improvement of the atmosphere. These results also confirm the conclusions of Wrigley de Basanta that especially species of *Licea* and *Macbrideola* are sensitive to air pollution.

[Lecture – MORF]

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A scanning electron microscopy study of selected *Badhamia* species

3 92 363

The myxomycete genus *Badhamia* has about 40 species worldwide with about 15 species in Japan. These species contain calcareous granules on the peridial surface and a capillitium consisting of a coarse network of calcareous tubules. SEM observations of the outer and inner surface of the peridium, the capillitium and spore ornamentation are illustrated for the following species: *B. affinis*, *B. capsulifera*, *B. crassipella*, *B. dearnessii*, *B. foliicola*, *B. gracilis*, *B. iowensis*, *B. lilacina*, *B. macrocarpa*, *B. nitens*, *B. obovata*, *B. ovispora*, *B. panicea*, *B. populina*, *B. rugulosa*, *B. spinispora*, *B. utricularis* and *B. versicolor*. These species were collected in the USA, Canada and Japan. Specimens were dried and coated by platinum–palladium ion sputtering on the surfaces. New morphological features of spore ornamentation fine structure will be documented. The sporangial wall of each species usually consists of an outer and an inner peridial layer. The outer layer has densely massed calcareous granules 1–1.5 µm in diameter. The capillitial network has different shapes in each species. The capillitial threads of *B. populina* are thick and flattened; in *B. utricularis* slender and partially expanded at the nodes. Internally capillitial threads are densely filled with calcareous granules. The outer surface of the sporangial wall has many pits connected to capillitial threads internally. This is typical for *B. capsulifera*, *B. gracilis*, and *B. iowensis*. Spores of *B. nitens* are ellipsoid. Examples of spore ornamentation include *B. affinis* with spines 0.4 µm long and 0.2 µm wide, *B. foliicola* with spines 0.2–0.3 µm long and wide, *B. gracilis* with warts 0.3 µm long and wide, *B. lilacina* with banded reticulation forming vein-like ridges 0.2 µm wide and 1 µm high; *B. obovata* has protuberances with a cauliflower-like top. The clustered spores of *B. crassipella* are shown for the first time with SEM.

[Poster – ECOL 1]

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Check–list of nivicolous myxomycetes

B 32 9[illegible]

The nivicolous myxomycetes is a group that defines itself by a very concrete ecology, since they fructify when snow melts in mountainous areas that have been covered by snow for several months a year. It will be therefore in spring when the nivicolous species will appear on the vegetation covered by the snow (shrubs, low branches of trees).

The knowledge of this group begins with the Swiss Charles Meylan who made numerous incursions in mountains of Jura, and the Northamerican Donald T. Kowalski that described different species from Rocky Mountains.

In the last years have appeared numerous nivicolous works relative to myxomycetes in different countries (Germany, Austria, Iceland, Japan, Norway, Russia, Switzerland, USA, Turkey, Scotland, Italy, Crete, Spain and specially from France by the group of Marianne Meyer) that have encouraged us to make one check–list of the Myxomycetes mentioned everywhere, based on all the known bibliography.

This check–list has been made in a data base in which all the data contributed in the bibliography are registered (name of the species, substrate, altitude, locality, date, etc.) that it is going to allow us not only geographically to group all the species mentioned at world–wide level, but also by its fenology or preferences by type of substrate or height.

In order to complete this first check–list we are asking for help for all the congress participants to correct and add other references.

[Key note lecture – ECOL]

B. Ing

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Why do myxomycetes occur where they do?

Myxomycetes are traditionally thought of as constituents of forest ecosystems but the factors which limit their distribution and substrate selection are largely unknown. Their role as scavengers suggests that they may be responsive to the suitability of available food organisms rather than having specific requirements. There is some evidence that some species are pH dependent whilst others may require high concentrations of available calcium. Temperature is possibly significant and rainfall may also be a limiting factor. Nevertheless there are few studies which have attempted to investigate these problems. At present we have far more questions than answers.

The aim of this paper is to direct attention to questions about the interaction of myxomycetes and their biological and physical environment. Are lignicolous species present in living wood and ready to take advantage of the death of the branch or trunk which they inhabit? Are some supposed lignicoles really corticoles which are able to survive the fall of the branch or trunk? Are all foliicolous species soil organisms which simply utilise leaf litter as a sporulation surface? Are dung species just foliicoles or are some really obligatorily fimicolous? Are nivicoles cold tolerant or are they using snow cover to prevent low temperature damage? Are they really aquatic species, dependent on melt water? Are the species associated with moss–covered rocks in ravines – a severely nitrogen–deficient habitat – forming symbiotic associations with cyanobacteria? What is the link between the substrates of succulenticolous species and those found on grass litter? Do the species found in decaying flowers in tropical forests find similar resources as the same species in temperate forest litter? Does the species of tree have any influence on the composition of corticolous myxomycota or is it just a matter of pH and water holding capacity? Why are grassland species, which are presumably soil organisms, different from litter species?

These are just a few of the relationships to be examined and suggestions for future research discussed.

[Lecture – ECOL 2]

B. Ing

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Corticolous myxomycetes in the Royal Botanic Gardens, Kew

B 92 966

The gardens at Kew contain over 1500 species of trees and shrubs, living in a compact area and sharing the same physical environment. The gardens present a nearly unique opportunity to examine the substrate preferences and small–scale distribution of corticolous myxomycetes. This project is a follow–up from work carried out in central London over the last ten years. To date over 300 tree species have been sampled and over 50 species of myxomycetes have developed in moist chamber culture. These include not only very common and widespread species but a large number of supposedly very rare species, including several which have only been described in the last three years.

Initial results suggest that pH and water–holding capacity are key factors which determine which myxomycetes live on which trees, but roughness of bark, presence of cryptogamic epiphytes and the role of arthropods, such as mites, psocids and collembolans, all require investigation.

This study is expected to require another two years to complete and a full analysis of the results will appear in *Kew Bulletin.*

[Lecture – TREN]

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C. EINVIK, T. FISKAA, K. HAUGLI, E. W. LUNDBLAD, E. SJØTTEM,
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Group I introns are very common in nuclear SSU rDNA and LSU rDNA of Myxomycetes

B 92 967

DNA sequencing of nuclear ribosomal RNA (rRNA) genes from 30 myxomycete species/ isolates have identified ca. 70 group I introns, which range in size from 300 bp to 2500 bp. These introns are distributed among 16 distinct sites (6 in SSU and 10 in LSU) within highly conserved parts of the rRNA genes. Group I introns constitute one of the main classes of introns in nature, and interrupt RNA– and protein coding genes in both eukaryotes and prokaryotes. All group I introns contain catalytic RNAs (ribozymes) responsible for intron splicing at the RNA level.

No introns were found in *Echinostelium* and *Arcyria*, but *Stemonitis* and *Comatricha* contain at least one and three introns, respectively. However, Physarida species appear heavily loaded with group I introns, and *Fuligo septica* contains as many as 12 introns in the same rRNA transcript (4 in SSU and 8 in LSU).

Introns at two positions in the LSU rDNA (L1949 and L2449) were present in all Physarida species/ isolates analysed. These atypical group I introns appear ancestral within the Physarida with no secondary losses during evolution. Thus, the L1949 and L2449 introns represent unique model systems for studying the molecular evolution, dynamics, and functional roles of insertion sequences. Other myxomycete group I introns have a more sporadic distribution among closely related species and isolates, probably due to recent lateral intron transfers. Five myxomycete introns are complex genetic systems that contain additional homing endonucleases protein genes. Detailed molecular characterizations of more than 20 myxomycete group I introns, including their corresponding ribozymes and homing endonucleases, are currently in progress in the lab.

[Lecture – TREN]

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Phylogeny of Myxomycetes based on combined nuclear SSU rDNA and LSU rDNA sequence data

Ribosomal RNA (rRNA) gene sequences have been extensively used in phylogenetic reconstructions for a variety of species at different taxonomic levels. Currently we have obtained ca. 200.000 bp unique sequence information of the rRNA genes from approximately 30 different species/isolates of myxomycetes.

Phylogenetic analyses have been performed using conserved sequence regions from both the small subunit (SSU) and (large subunit) LSU rRNA genes of species representing the different taxa: Echinosteliida (*Echinostelium*), Trichiida (*Arcyria*), Stemonitida (*Stemonitis* and *Comatricha*), and Physarida (*Physarum* [7 species], *Badhamia* [2 species], *Fuligo*, *Physarella*, and *Didymium* [5 species]). In addition to the myxomycetes, one species representing the protostelids (*Soliformovum*) and two species representing the dictyostelid cellular slime moulds (*Acytostelium*, *Dictyostelium*) were included.

Preliminary analysis indicates that the myxomycetes are early branching protists with a monophyletic origin. The protostelids branch out at the base of the myxomycete tree, followed by Echinosteliida and Stemonitida. Interestingly, the genus *Physarum* appears diverse and seems to include the genus *Badhamia*.

[Key note lecture – MORF]

I. KALYANASUNDARAM

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Morphological diversity in the Myxomycetes

The wide variety of form in the Myxomycetes – ranging from the simple minute Liceas and irregular aethaloid fructifications to the delicate and lacy Stemonitises and Arcyrias; from the simple protoplasmodium to the complex phaneroplasmodium that may extend over a few meters – offers a fascinating subject for a study of pattern information.

The fructifications, even when aethaloid, rarely occur singly but are in a colony. The manner of disposition is fairly constant for a given taxon, ranging from a dense crowding in many sessile forms to an irregular scattering as in several Didymiums, and a uniform, evenly spaced pattern common to many stipitate Physarums, Crateriums, Diacheas and Lamprodermas.

The evolution from the aethaloid or sessile form to the stipitate, necessitated a strengthening of the stipe, and this has been achieved in diverse ways in the different taxa. The elongation of stipe or sporangium has often been associated with evanescence of the peridium and its replacement with fascinating patterns of thickenings.

As for the spores, these display such a variety of ornamentation that mycological terms become inadequate to describe them and palynological terms are called for.

The chemical nature of the different parts of the fructifications still merits further study. The presence of polymers of galactosamine – a substance regarded as rare in biological systems – is an interesting feature. In all spores of varied hues, the presence of melanin seems to be a common feature. The additional pigments that give the bright-spored taxa their varied hues – some of which have been ably elucidated by a German group – still offer a fertile field for study.

The plasmodium has attracted intensive investigation mainly because of the fascination for the shuttle type of streaming. It is this that has led to the elucidation of the orientation, ultrastructure, chemical nature and the function of the microfibrils that play so prominent a role in the plasmodium as well as in the swarmcells and myxamoebae, with a substantial contribution from Japanese scientists.

The "Physarum Research Group" working mainly with axenic cultures of *Physarum polycephalum*, has contributed greatly to our knowledge of the myxomycete genome, and the intricacies of nuclear division that switch so miraculously from astral to anastral, and display a synchrony that is unparalleled in the living world.

The metamorphosis of the living, pulsating plasmodium into the exquisitely hibernating fructifications, howevere fascinating, is little understood, except for some aspects of proteinaceous changes during development. The physical and biochemical processes involved still merit extensive and intensive study, given the wide range of variation in form.

For a better understanding of the relationship of morphology to cytology and development, an appeal is made for a better collaboration of general myxomycologists with physicists, chemists and molecular biologists.

[Lecture – FLOR 1]

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A positive ecological role for tropical myxomycetes in association with bacteria

B 92 970

The commonly held belief that myxomycetes are mere objects of curiosity, with no economic importance, needs to be changed. The myxomycetes do have their definite role in the ecosystem, as do other microorganisms. Some of these interesting and unexpected roles will be highlighted in this lecture.

The studies made in our laboratory over the last 40 years with plasmodial cultures have shown that each culture is closely – and almost inseparably – associated with a single bacterial species. We refer to it as the bacterial associate of the respective plasmodium, which in term we call the associated plasmodium. Only during the last 20 years have we made an intensive study of the nature of this association. Our studies have revealed that

1) The bacteria that form associations with myxomycete plasmodia belong mostly to the Enterobacteriaceae.
2) In association with the plasmodia, the bacteria can fix atmospheric nitrogen.
3) The associated plasmodia can produce extracellular enzymes capable of degrading wood polymers.
4) The associated plasmodia can actually degrade certain types of wood and litter.
5) The associated plasmodia can tolerate high concentrations of toxic heavy metal salts, decolourize certain azodyes and utilize several hydrocarbons as sole source of carbon.

These observations suggest that myxomycete plasmodia, in close association with certain types of bacteria, play a definite role in the recycling of nutrients on the forest floor, and also have a good potential for the bioremediation of xenobiotic pollutants.

[Lecture – TREN]

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Arcyria nutans a name still recognized

Per Onsberg in Mycologia 1978. 70: 1284–1286 makes the case for nomenclatural priority for the specific epithet *obvelata*. This is based on copper–engraved tabulae in folio with parallel text published by G. C. Oeder as part of the Flora Danica. The illustration on page 1285 and brief Latin description do not create a convincing likeness of *Arcyria nutans* (Bull.) Grev. Indeed, a portion of the habit represented by a group of unopened sporangia enclosed by a common membrane is clearly the result of aberrant development. A group of stalked sporangia appear to have prematurely dried and fail to show the striking character of the highly elastic capillitium that expands into fluffy masses several times the normal height of the sporangium. This elastic capillitium then droops or pulls away from the calyculus. There is one sporangium showing a vertically expanded capillitium that obviously represents a species of *Arcyria*. It is highly questionable that this illustration represents *Arcyria nutans*. This species is found in most myxomycete monographs under the name *Arcyria nutans*. Because there is no type specimen and the illustration is clearly questionable as to which species of *Arcyria* it applies, it is best to retain the name *Arcyria nutans*.

[Key note lecture – ECOL 2]

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Tree canopy and corticolous myxomycetes

B 92 912

Methodologies for accessing the tree canopy include hot air balloons, dirigibles, cranes with gondolas, cherry pickers, elevated platforms or walkways, inflatable platforms, tree houses or bridges, ladders, towers, free hand climbing, tree climbing spurs, and rope climbing techniques. A video tape demonstration will be shown of the double rope climbing technique entitled "A Study with a View" filmed on site in the Great Smoky Mountains National Park, USA. Advantages and disadvantages will be discussed for the single and double–rope climbing techniques. Certain species of trees such as *Acer rubra*, *Fraxinus americana*, *Juniperus virginiana*, *Liriodendron tulipifera*, *Pinus strobus*, *Quercus alba*, and *Ulmus americana* support high species richness. Older champion–sized trees in the GSMNP produced greater numbers of myxomycete species more typically found on ground sites, for example, *Hemitrichia serpula*, *Trichia botrytis*, and *Trichia favoginea*. This was in contrast to the same tree species in midwestern states where overall tree size was smaller with much less annual rainfall that failed to produce these same ground site myxomycete species. Tree canopy biodiversity inventory in the GSMNP indicates that bark collections support species of mosses, liverworts, lichens, and macrofungi that are also found on ground sites. Only the Myxomycetes are represented by species found on the bark of living trees and vines and not on ground sites. This group of corticolous myxomycete species is usually tiny, produce resting stages that survive unfavorable dry periods or variable temperatures, and develop fruiting bodies rapidly within 24 to 72 hours. Mean pH is a major factor in the assemblage of myxomycete species on the bark of living trees. *Pinus strobus* with a mean pH of 3.8 was correlated with myxomycete species abundance represented in rank order by *Echinostelium minutum*, *Comatricha ellae*, *Enerthenema papillatum*, *Physarum nutans*, *Cribraria confusa*, and *Clastoderma debaryanum*. In contrast *Fraxinus americana* with a mean pH of 6.7 was correlated with species abundance represented by *Macbrideola cornea*, *Cribraria violacea*, *Perichaena chrysosperma*, *Physarum crateriforme*, *Macbrideola scintillans*, and *Calomyxa metallica*.

[Lecture – ECOL 2]

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A new tree canopy myxomycete in the Great Smoky Mountains National Park

591 340

A new species of *Diachea* was discovered by undergraduate student climber Melissa Skrabal in the Cades Cove vicinity of the GSMNP. A hike of approximately 1.7 km from Turkey Pen Ridge Trailhead to the intersection of School House Gap Trail marks the site of the *Quercus alba* tree. This same tree was climbed twice, once in the summer of 2000 and again in 2001. Distinct plasmodial tracks on the bark surface appeared at 9 m above ground level up to 24 m with the total tree height 27.4 m. Bark samples were gathered at 3 m intervals yielding both plamodial tracks and perfectly formed stalked sporangia on the surface and in crevices of the bark. Moist chamber bark cultures produced a bright yellow phaneroplasmodium and developmental stages of the sporangia. In culture the plasmodium migrated over the upper and lower bark surfaces, mosses, and covered the filter paper in the bottom of Petri dishes. Mature sporangia developed on upper and lower bark surfaces, on the moss phyllidia, on the filter paper, and on the sides of plastic Petri dishes. Another tree, *Juniperus virginiana,* located along the Cades Cove Loop Road, produced abundant sporangia of the new *Diachea* in moist chamber cultures. This tree was about 12 meters in total height with plasmodial tracks and sporangia developing from 4.6 to 9 meters. A *Fraxinus americana* tree located off Cades Cove Loop Road along Rabbit Trail also produced the *Diachea* at heights of 20 and 23 m with a total tree height of 30.5 m. Over 20 moist chamber cultures from all three trees failed to produce the yellow plasmodium or sporangia using bark sampled at 3 m. The following brief description is based on 15 collections of the *Diachea* from all of these trees. Sporangia gregarious, not closely crowded, often stipitate, up to 1.27 mm in total height, varying to sessile, globose, spore case 0.43–0.69 mm; peridium membranous, persistent, iridescent, ranging from gold to silvery–gray with a ring of iridescent rainbow blue at the base; dehiscence occurring naturally when mature, irregular from apex, usually with basal remnants; hypothallus not apparent; stalk erect, with calcareous crystals throughout, height up to 0.76 mm, enclosed by a membrane 2.5 μm thick, wrinkled, reddish orange to pinkish red; columella structurally similar to stalk, more or less cylindric, tapering to a narrower point at apex of sporangium, height 0.14–0.31 mm; capillitium consisting of dichotomously branched, smooth, hollow threads free of peridium, arising from tip of columella; spores globose, free, dark brown to black in mass, 11–14.5 μm in diameter in optical section including ornamentation, pinkish walls 1μm thick, with light microscopy appearing spiny with truncate ends, with SEM ornamentation uniformly covering spore surface with vertical processes with a cauliflower–like irregular tip. Phaneroplasmodium bright yellow, conspicuous, extending up to 11cm. The distinguishing characters of this new species are the combination of colors, the capillitium arising only from the tip of the columella, the spore ornamentation, and the microhabitat in the canopy of living trees. *Diachea silvaepluvialis* M. L. Farr, *D. verrucospora* Nann–Bremek. & Y. Yamam., and *D. thomasii* Rex all have colored stalks and variable iridescent colors exhibited by the peridium. In all of these species the capillitium arises throughout the length of the columella. The character of the columella is striking in the new *Diachea* species because the stiff capillitial threads often project upward from the tip of the columella when the sporangia are windblown. This research project is funded by the National Science Foundation, Division of Environmental Biology, Biotic Surveys and Inventories Program, Award # DEB–0079058 and Discover Life in America Award #2001–26.

[Poster – ECOL 2]

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Cryptogam tree canopy biodiversity in the Great Smoky Mountains National Park

Objectives are to complete the first comprehensive survey and inventory of tree canopy biodiversity for cryptogams (Myxomycetes, macrofungi, mosses, liverworts, lichens, and ferns), tardigrades, and molluscs in the Great Smoky Mountains National Park (GSMNP), USA above 3 meters in the canopy of living trees and vines; to assemble a multidisciplinary research team of experts who will collect, identify and curate this diverse group of organisms; to compare the assemblages of tree canopy targeted organisms with those of ground sites; to search for species new to science in all of the targeted groups of organisms; to involve volunteers, park interns, undergraduate and graduate students, and project personnel in park interpretive exhibitions, news media coverage (print and television), and publication of articles in popular magazines that will send a powerful conservation message for biodiversity.

Hypothesis

Species of tree canopy cryptogams found on the bark of living trees and vines above 3 meters differ from those found in habitats on ground sites.

Introduction

The (GSMNP), which comprises more than 200,000 hectares, serves as a refuge for one of the richest and most diverse biotas in the temperate regions of the world. It also has the largest remaining tracts of old growth forest in Eastern United States, estimated at 40,000 hectares. A new research initiative called the All Taxa Biodiversity Inventory (ATBI) under the rubric of a non–profit organization, Discover Life in America (DLIA), represents a research effort to inventory and identify all of the life forms in the park. Life in treetops must adapt to different environmental conditions and species found there are often distinct from the surrounding biotic communities (Benzing, 1995).

Materials and methods

Our tree canopy studies employed the double rope climbing technique because the climbers could advance to higher levels in the tree canopy (Jepson, 2000). A Big Shot slingshot is used to shoot a slick line attached to a weighted throwbag over crotches and branches usually at heights of 18 to 24 meters. A climbing rope is attached to the slick line and pulled over the limb. This rope is tied to a climbing saddle and a friction knot used to vertically ascend the rope. Safety was emphasized in all of our activities. Student climbers completed a training school taught by a professional arborist.

Survey methodology and study areas

The All Taxa Biodiversity Inventory management plan established 20 one–hectare study plots scattered through the park. Site selection was based on major forest/vegetation types, elevation and relative accessibility. Certain sites included old growth forest such as Tremont, Ramsay Cascades and Albright Grove. Champion–sized trees such as tulip poplar and white oak were located with the help of park personnel and hiking trail books (Gove, 1999). Each tree climbed was entered in a database that included a tag number for each tree, numbered samples at three meter intervals up to 40 meters measured with elevation lines, diameter at breast height, total height of tree, climber's name, observations of *in situ* specimens on the tree trunk, place location description and global positioning system reading, altitude, and weather conditions. All student climbers were given tutorials that included lecture slide shows, demonstration specimens, practice keying, and field experience with experts from the multidisciplinary research team that enabled them to recognize and collect the targeted groups of organisms.

Laboratory moist chamber cultures for myxomycetes and macrofungi

The moist chamber culture technique is used to process field–collected samples of bark and epiphytes from living trees and vines by placing the bark sample on a sterile filter paper disk in a sterile Petri dish with the addition of sterile water to moisten the contents. Any excess water is poured off in 24 hours and the cultures incubated at 25°C for up to four weeks. Cultures are examined daily to observe plasmodial and fruiting body development, record data on time of maturation, and harvest fruitings in a fresh fully mature state for preservation and identification (Keller and Braun, 1999).

Results

Tree Climbing Activities: a total of 240 trees representing 35 different tree species were climbed during two three–week periods in June, July and August of calendar years 2000 and 2001. Myxomycetes: total number of species (107) recorded from the tree canopy. Total number of new records for the GSMNP from the tree canopy (51) represents 48 per cent. Total number of species (30) only known from living trees and vines (28 per cent). Total number of species known from tree canopy and ground sites (77) represents 72 per cent. A new species of *Diachea* was restricted to heights above 6.1 to 21.3 meters. This is the first upper tree canopy species documented for the Myxomycetes. Apparently the Myxomycetes are the only group of cryptogams with obligate tree canopy species. Macrofungi: five basidiomycete species were collected from the tree canopy with no new records for the GSMNP. All of these species are commonly found on ground sites. Mosses: twenty–two moss species were collected from the tree canopy with no new records for the GSMNP. Liverworts: sixteen liverwort species were collected from the tree canopy with no new records for the GSMNP. All of the moss and liverwort species are commonly found on ground sites. Lichens: fieldwork during the summer of calendar year 2000 produced 2,750 lichen samples taken from the tree canopy of 141 trees, which yielded 193 species of lichens, and of these 78 are new lichen records for the GSMNP. All lichen species recorded from the tree canopy also occur on ground sites. Vascular Epiphytes: *Polypodium appalachianum* is a fern species typically found growing on rocks, other ground sites, and occasionally as an epiphyte at the trunk base of living trees. Its discovery as a tree canopy epiphyte in a champion–sized *Liriodendron tulipifera* tree at 35.1 meters and at at 39.7 meters on a horizontal branch was documented for the first time.

This research project is funded by the National Science Foundation, Division of Environmental Biology, Biotic Surveys and Inventories Program, Award # DEB–0079058 and Discover Life in America Award #2001–26.

[Lecture – ECOL 2]

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Student research experiences in the Great Smoky Mountains National Park

This research project emphasized student involvement in tree climbing activities, collection of tree canopy cryptogams, database management, and laboratory moist chamber culture work as part of the National Science Foundation Research Experiences for Undergraduates Program. All student climbers completed a training school taught by Charly Pottorff, a professional arborist. Only the students who were certified in the basic double rope climbing technique were selected to climb in the GSMNP. There were no climbing injuries during our four summer field trips while climbing over 240 trees in the park. All student climbers were given tutorials, lecture slide shows, specimen demonstrations, practice keying, and field experience with experts from the multidisciplinary research team that enabled them to recognize and collect Myxomycetes, macrofungi, lichens, mosses and liverworts. Students recorded their daily field experiences in a diary that later served as the basis for published articles. A television feature story entitled "A Study with a View" was part of WBIR's Heartland Series hosted by Bill Landry from Knoxville, Tennessee. This program celebrates the people and the land of the entire Appalachian region. The television crew spent two half days shooting the climbing and sampling techniques of the student climbers from CMSU. Many of the panoramic views were shot from a cherry picker with the cameraman in the bucket at a height of 18 to 21 meters. Coverage from published articles and the television media sent a powerful conservation message for biodiversity. Students made night field trips that resulted in collecting myxomycete sporangia with a flashlight. A small handheld flashlight with a spotlight enabled students to collect myxomycetes on the underside of decaying logs. Tiny myxomycete sporangia glisten and become more conspicuous when directed light rays highlight areas of the log difficult to observe in daylight hours. Observations and photographs were also made at night from 10:00 PM to 2:00 AM of slugs feeding on the immature, sporangia of *Stemonitis axifera*. Each night *S. axifera* developed numerous colonies of stalked sporangia with soft, milky white spore cases. Many sporangia of all stages were present each night, including soft reddish–brown pigmented, immature stages and mature, powdery–spored stages. Each night three to five slugs (*Philomycus carolinianus*) migrated from underneath the flaps of bark along the sides to the more exposed wood on the upper side of the log. These slugs with extended anterior tentacles moved preferentially toward the immature milky white sporangia, passing by all other more mature stages. The slugs fed on the milky white, stalked sporangia eating each sporangium from the top downward. Entire groups of the immature sporangia were eaten within two to three minutes. The slugs had a negative reaction to the flashlight and camera flashes; anterior tentacles were quickly withdrawn and

feeding stopped. If total darkness was maintained for several minutes the slugs returned to feeding. Another remarkable discovery was the typically lithophilic *Polypodium appalachianum* fern growing as a canopy epiphyte 35 to 40 meters above ground level on a horizontal branch of a champion–size *Liriodendron tulipifera* in the GSMNP. Occurring along with this fern was an assemblage of terrestrial mosses including *Rhodobryum roseum*, an assortment of collembola (springtails), and a flightless proturan insect species (*Acerentulus confinis*) only known from soil and litter. The distinctive features of this canopy habitat may effectively duplicate ecological conditions normally found only at ground level, establishing the opportunity for translocating an entire community and providing biologists with new insights on the origin of some epiphytes. This research project is funded by the National Science Foundation, Division of Environmental Biology, Biotic Surveys and Inventories Program, Award # DEB–0079058 and Discover Life in America Award #2001–26.

[Poster – FLOR 2]

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Study of Myxomycetes in Ukraine

In general conditions in Ukraine are good for myxomycetes. Study of these organisms in Ukraine has, however, never been a popular pursuit. Available information about myxomycetes in Ukraine is meagre and fragmentary. Jozef Jundzill was the first to report their occurrence in Ukraine (Jundzill, 1830), but without mention of identifiable locations, and most of his work dealt with Lithuania, so there is no certainty that all thirteen myxomycete species mentioned in his work were found in Ukraine. Some mention was made of Ukrainian myxomycetes in the mid– to late 19th century (Borszshow, 1868; Leveillé, 1842; Valts & Rishavi, 1872), while study of myxomycetes in the western region of Ukraine, especialy in the Carpathian Mountans was provided by Polish investigators (Krupa, 1886, 1888, 1889; Krzeminieuska, 1934, 1937; Namyslowska, 1939; Namyslowski, 1914; Jarocki, 1931), although not all species mentioned were reported as definitively Ukrainian slime moulds. During the first half of the 20th century reviews on Ukrainian myxomycetes by Celle (1925) and Pidoplichko (1932) were published, and some sites of myxomycetes were reported (Benike, 1914; Lavitska, 1949; Yachevsky, 1907). The compilation "Handbook of the Fungi of Ukraine" (Morochkovskii *et al.*, 1967) completed the first period of myxomycete recearch in Ukraine, aggregating one hundred and thirty–two species of myxomycetes. The present state of knowledge was summarized in "Fungi of Ukraine, an annotated checklist" (Minter & Dudka, 1996), and by Leontjev & Akulov (2001), using generally more up–to–date nomenclature. Most recently research of myxomycetes in Ukraine has become more active than ever before, with publications giving more information about these organisms as follows.

1. Distribution:
    - 1.1 South region – Crimea (Dudka, 2000; Dudka *et al.*, 1999; Novozhilov, 1988; Romanenko, 2001a, 2001b, 2001c, 2001d, 2001e);
    - 1.2 Western region – Carpathians (Dudka & Krivomaz, 1996) and Polissia (Krivomaz, 1998);
    - 1.3 Central region (Akulov & Leontjev, 2001a, 2001b; Glushchenko *et al.*, 2001; Krivomaz, 2001; Romanenko, 2000).
2. Ecological groups:
    - 2.1 Corticolous species (Novozhilov, 1988; Romanenko, 2001a, 2001b, 2001c, 2001d, 2001e);
    - 2.2 Snowfield species (Dudka, 2000);
    - 2.3 Leaf inhabiting species (Romanenko, 2001e);
    - 2.4 Lignicolous species (Dudka & Krivomaz, 1996; Krivomaz, 1998, 2001; Romanenko, 2001);
3. Myxomycete taxonomy (Akulov & Leontjev, 2001b; Novozhilov, 1985).
4. Myxomycete–insect relationships (Perkovskiy & Krivomaz, 1994, 1995, 2000).

[Key note lecture – SYST]

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Nomenmyx. A nomenclatural taxabase project

B 92 977

Botanical nomenclature is a complex of rules, principles and recommendations that govern scientific naming in botany and mycology. It is the basic pillar of taxonomy and the complete rules are detailed in the International Code of Botanical Nomenclature (ICBN), the latest version of which was approved at the XVI International Botanical Congress held in St Louis (Missouri, USA) in 1999. Botanical nomenclature is a means of channelling the outputs of research in systematics for general consumption. It is not only the taxonomist's concern but is of relevance for all who need to communicate about organisms. The IAPT (International Association for Plant Taxonomy) is the world authority on this topic and the body charged with electing a committee of experts to edit the ICBN, to review its articles, and to channel and evaluate proposals. To give a valid name a series of simple requisites established by the Code must be followed, but all too frequently researchers forget or do not follow these and their work is therefore not legitimate. To minimized this effect, when describing a new species or proposing new combinations the ICBN should be used as the most fundamental text and its articles utilized, in order to facilitate correct publishing and legitimate nomenclatural proposals for myxomycetes. According the ICBN the starting point for the nomenclature used for Myxomycetes is the 1st of May 1753, publication date of the Species Plantarum of Linnaeus. Since then almost 4000 names have been applied to the Myxomycetes. Many species have been combined under several genus names however, and in a number of cases, incorrect authors' names and erroneous citations have been used, so it became evident that this was a problem of some complexity and there was urgent need for an updated compilation of all the proposals. "Nomenmyx" was designed as an inventory of names used in the literature. The inventory takes as starting point the impressive monograph of Martin & Alexopoulos (1969), and all the names proposed since then have been added. At present of the 4000 names applied to various taxa of myxomycetes, only 900 are legitimate names for accepted species, 2100 are obligate or facultative synonyms, and about 1000 are invalid or of doubtful application. The taxabase compiled all the data in a standard format with the following fields or blocks of information: 1.– Name of taxon (including the genus name, species epithet, infraspecific rank (if aplicable), infraspecific epithet (if applicable), author(s) name(s), reference to the protologue and year of publication. 2.– Basionym (if different). 3.– Accepted name (if different). 4.– Reference to the source of information. 5.– Comments. Authors' names, titles of journals, and the book titles have been abbreviated according to the recommendations of the ICBN, and pursuing a universal standard. In Nomenmyx a name could be an accepted name, a basionym, a homo– or heterotypic synonym, an invalid, excluded or doubtful name. In the case of illegitimate names, a reference to the article of ICBN that illegitimate it is included. This research was supported by Grant#99075 from the US–Spain Science and Technology Program [Fulbright Program].

[Poster – ECOL 1]

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Species richness and ecological requirements of nivicolous Myxomycetes from the Iberian Peninsula

The nivicolous myxomycetes are an ecological group of species that live near melting snow in alpine regions all over the world but under certain conditions they can be found further south in the Mediterranean basin. The knowledge of these species in Iberian Peninsula is scant and a more widespread sampling of all the mountainous regions of the Peninsula is necessary to determine what species are represented and their distribution and ecological growth requirements. The irregular precipitation with years of abundant snow and other years of almost none in the southern part of the peninsula causes irregular development and sporulation phenology among the organisms. It is therefore essential to spread fieldwork over several years when working in these latitudes in order to get a true picture. Some years abundant fructifications appear and others there are few, and good years for some mountainous areas are very poor for others. Ten years ago, a series of field collectioning trips, of the mountainous regions of the Iberian Peninsula were initiated from the Pyrenees in the North to the Sierra Nevada in the South. The mountains selected have elevations from 1500–2000 m, with the highest being 3200 m, the altitude considered maximum for the development of these myxomycetes. The sporulation phenology, also depending on the latitude, is limited in this region to April–June, but it can frequently be limited to two or three weeks of this period.
As result of this project, over 1400 specimens of more than 40 species were collected. A list of nivicolous myxomycetes of the region is presented, and their distribution is discussed. At the present time, about 80% of the species sampled are strictly nivicolous and about 20% more are facultative nivicoles. Their distribution which falls into three ecological groups, species linked to the shaded timberline, species linked to alpine shrubland, and species found in alpine meadows, is also analysed. This work has been supported in part by the Spanish Government through grant PB98–0538–C04–01, "Flora Micologica Iberica" project.

[Poster – ECOL 3]

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A study of the succulenticolous Myxomycetes from arid zones of Mexico

D 92 979

The stereotype image of the Neotropics is of tropical forests, but this diverse and rich biogeographic region has extensive arid and semiarid territories which extend from México and Mesoamerica to Peru, Bolivia and Northern Chile as well as Argentina and Northwest Brazil. The importance of these territories is considerable due to the large number of endemic plants of the families Cactaceae and Agavaceae that grow there. Associated with the decaying stems of these plants there is an ecological and very specialized group of myxomycetes called succulenticolous species. Five years ago two teams of researchers from Madrid (Spain) and Tlaxcala (Mexico) started an inventory of the species that appear in the arid lands of Mexico. The project has as objective to identify and describe the group of myxomycete species associated with the microhabitats and dominant vegetation types of these lands. The ultimate aim is to reach a more precise understanding of the ecology and the distribution of the species, as well as the examination of species–substrate relationships in these extreme environments. The arid lands from Central Mexico (Hidalgo, Mexico, Oaxaca, Puebla, Querétaro, Tlaxcala and Veracruz States) were chosen for the study. The mean annual temperature of these lands is 16–30°C and their mean annual precipitation 300–500 mm. Different types of xerophyllous scrublands, some with columnar cacti (*Myrtillocactus, Pachycereus, Stenocereus, Neobuxbaumia*, etc.) and others with tree Opuntias or spiny scrub (*Yucca, Nolina, Beaucarnea, Agave, Dasylirion*, etc.) were selected. The localities have around 30% of endemic plants and are situated in one of the so–called "hot spots" where species conservation is deemed most urgent. Several intensive field collecting trips were made during the course of five consecutive years and coinciding with the end of the rainy season (middle September). About 1200 myxomycete field collections have been recorded. The study was complemented with 300 moist chamber culture collections of different substrates. Some of the myxomycete species such as *Cribraria zonatispora, C. fragilis, Didymium mexicanum* or *Trichia agaves* have been recently described from these arid lands and seem exclusive to this kind of succulenticolous substrate. Others like *Badhamia melanospora, Didymium vaccinum, Hyporhamma minor, Perichaena luteola, Ph. compressum* or *Ph. straminipes*, are also very abundant but not exclusive. The pH value of the substrates as factor for the development of the species is also analyzed. This research was supported by the Spanish and Mexican Governments by mean of a bilateral grant between CSIC–CONACyT.

[Lecture – FLOR 1]

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Rapid biodiversity assessment of the Myxomycetes from the Yasuni Biosphere Reserve (Ecuador)

It is a well known fact that some of the greatest diversity of organisms of the planet is found in the Neotropics, and that conservation "hot spots" have been identified in this enormous biogeographical region. The knowledge of myxomycetes from the area, which includes Central and South America, is proportionally scant. At present large areas of the Neotropics like the tropical Andes, the Amazon basin, the Choco, the Darien, and many different kinds of vegetation like the mangrove swamps, the xerophytic vegetation, and some types of tropical forest, remain unexplored. To address this lack of information, in the last five years a few projects supported by the U.S. and Spanish Government have been directed towards this rich and varied biogeographical region. In April 2000, the first three authors had the opportunity to carry out a two week field study of a previously unexplored region, the Yasuní National Park and Biosphere Reserve. This park is located in Ecuador (Orellana Province) on the Amazon basin, at the Equator, and is made up of 980.000 hectares of pristine tropical rain forest. The climate of the region is typically tropical with a mean annual temperature of 25–28°C and a mean annual precipitation of 2500–2700 mm. The field work was made possible thanks to the infrastructure and support provided by Pontificia Universidad Católica of Ecuador. More than 300 myxomycete field collections were made, but only the most representative or novel specimens were collected because of the nature of the Reserve as an area of conservation. For all other samples the type of substrate was noted along with its diameter, degree of decomposition, humidity, shade, etc., to enable us to establish the abundance of the species and some ecological parameters. The field work also enabled collection of 215 small pieces of substrate for moist chamber cultures which produced a further 251 collections. As a result of this survey 89 taxa of 25 genera were identified, considerably increasing the knowledge of myxomycetes of this region of the world, particularly as a species of *Hyphoramma* has been described as new to science. *Arcyria afroalpina* was confirmed as tropical and not exclusively afroalpine, *A. cinerea* was recorded extensively but various biotypes have been recognized, all the species of the genus *Famintzinia* described in the world were present in this Park, which confirms the tropical distribution of this genus. In addition, eight collections from the genera *Didymium*, *Paradiacheopsis* and *Physarum* are possibly undescribed

species, but further samples are needed to confirm their identity and the stability of their characters. This research was supported in part by grant (DEB–9705464) from the National Science Foundation and the US–Spain Science and Technology Program [Fulbright Program] (Grant#99075).

[Poster – FLOR 2]

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Cellular slime molds of the Great Smoky Mountains National Park, U.S.A.

As part of the All Taxa Biodiversity Inventory (ATBI) project currently being carried out in the Great Smoky Mountains National Park, an ongoing survey of dictyostelid cellular slime molds has yielded a combination of previously reported species together with additional Park records as well as a number of species possibly new to science. As results from previous studies conducted elsewhere in the world have indicated, there appear to be assemblages consisting of particular species of dictyostelids characteristically associated with certain habitats in the Park. In many cases, the distribution pattern of a given species can be related to the differences that exist from place to place for such environmental parameters as elevation, soil pH and moisture regime. In this presentation, we report on the current status of the ATBI dictyostelid survey and discuss some of the more interesting and/or unusual species discovered thus far. This study is supported in part by a grant from Discover Life in America.

[Lecture – FLOR 1]

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Neotropical cellular slime molds. Some recent collections

We report here the results of surveys for cellular slime molds conducted over the past 3 years in Costa Rica, Ecuador, Mexico and other locations in the Neotropics. Standard collection and isolation techniques were used in these surveys. Most of the cellular slime molds isolated in these surveys have been previously recorded from the neotropics, but we have also isolated several species not previously reported from these particular regions or from similar vegetation situations in other parts of the new world tropics. Among the many isolates obtained in the course of this survey work are some cellular slime mold forms that do not seem to correspond to formally described species and therefore may represent species new to science. These surveys were supported in part by grants from the National Geographic Society and the National Science Foundation.

[Lecture – SYST]

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Symphythocarpus is polyphyletic?

Some new arguments for the relations between *Stemonaria* and *Symphythocarpus*

Since N. E. Nannenga–Bremekamp created on the base of *Stemonitis* and *Comatricha* three related genera, *Stemonaria, Stemonitopsis* and *Symphythocarpus*, the validity of this reform and character of connections between foregoing taxa remains opened to discussions. Solution of this problem can be promoted by the analysis of transitional forms, combining morphological features of several genera. In the summer of 2001 we found a sample of an unknown *Stemonaria* species, which had some resemblance with *Symphythocarpus*. In our opinion, it can serve for better understanding of relations between these two genera. The short description of this sample is given further.

Sample CWU–MS–1–002. *Frutification* consist of 9–11 oblong stipitate sporangia, conglutinated by the lateral surfaces, and forming the inclined pseudoaethalium–like body, located on the vertically standing free stalks of sporangia. *Sporangia* brown, cylindrical, 3–5 mm long, 0,2 mm in diam. Bases of sporangia are acute. *Stalks* black, corneous, 4–6 mm long, slightly excel the sporangia in length. *Hypothallus* filmy, translucent, brownish. *Capillitium* consist of thin and straight skeletal threads and tortuous peripheral ones, forming an irregular and breached surface net. Capillitia of neighbour sporangia don't interflow. *Spores* brown, 5–5,5 µm, vaguely sculptured. It is clear, that MS–1–002 belong to the *Stemonaria* because of its breached capillitium net, corneous stalk and habitual resemblance with some *Stemonaria* species, as *S. reticulospora* Nann.–Brem., Sharma, Thind. or *S. pilosa* Nann.–Brem. But sporangia confluence brings MS–1–002 together with the *Symphythocarpus*.

N. E. Nannenga–Bremekamp and other authors suppose that *Symphythocarpus* originate from *Stemonitis*. But examination of sample MS–1–002 shows, that the *Stemonaria*, just like the *Stemonitis*, can give rise to the symphythocarpoid forms. Therefore, even if we presume, that *Stemonitis* and *Stemonaria* are monophyletic taxa, *Symphythocarpus* has to be considered as polyphyletic. In means, that the genus *Symphythocarpus* has to be divided in at least two sections, which are to be raised up to a level of independent genera, or, better, to be included in the, correspondingly, *Stemonitis* and *Stemonaria*. But realization of these changes is now complicated because of several problems. First, there are no objective criteria for the division of *Symphythocarpus* in *Stemonitis* and *Stemonaria* parts. Second, there is no evidence, that *Symphythocarpus*–like forms can originate only from the foregoing genera. For example, *S. confluens* (Cooke et Ellis) B. Ing et Nann.–Brem. has ovoid sporangia, which brings it together with *Comatricha*, but the absence of columella and stalk in this species impedes to check this supposition. And third, there is no proof, that peculiarly *Stemonitis* and *Stemonaria* are monophyletic. Probably, the whole system of genera, mentioned here, has to be reformed.

[Poster – SYST]

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Taxonomic study on *Didymium floccoides*

Didymium floccoides Nann.–Bremek. & Y.Yamam. was first described in 1987 on the basis of Japanese specimens, and has been reported only from the type locality. The taxonomic information on this species was limited to the descriptions from the type specimens. In the course of my taxonomic study on the genus *Didymium*, over 20 specimens of this species were newly obtained in Japan. In this study, the type specimen and the additional materials of *D. floccoides* were morphologically examined to supplement the descriptive information of this less known species.

Didymium floccoides is characterized by the following features: (1) The stalk consisting of a mass of refuse matter, without a semitranslucent peripheral layer, and with rugged surface; (2) the columella usually containing air; (3) the pale colored spores with very fine warts and scattered clusters of dark warts; (4) the sporotheca often being conical when well–developed. The relatively wide morphological variations of this species can be recognized in the following characters: the peridial color (purplish brown to colorless), the columella shape (conical, subglobose to cylindrical) and color (dark brown to white), and the lime content of stalk.

In the course of my taxonomic study, the type specimens of *Didymium columella–cavum* Hochg., Gottsb. & Nann.–Bremek. were also re–examined. As a result, *D. columella–cavum* is judged to be conspecific with *D. floccoides* from the viewpoint of the sporophore morphology. However, there is a great geographical distance between the known localities of *D. columella–cavum* and *D. floccoides*. *D. floccoides* has been reported only from Japan, and *D. columella–cavum* only from Brazil. Similar distribution pattern is known also in *D. leoninum* Berk. & Br. and in *D. floccosum*. G.W. Martin, Thind & Rehill. *D. leoninum* has been recorded from Asia, Australia and South America, and *D. floccosum* from Asia and South America. More detailed biogeographical information and investigation using other methods, e.g. molecular–biological methods, were needed to understand this disjunct distribution pattern.

[Lecture – FLOR 1]

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Myxomycetes from North Queensland

In July 2001 I spent 3 weeks in Northern Queensland. I first visited Fitzroy Island, 29 km. SE of Cairns, a National Park, partly covered by rainforest in which field collections of myxomycetes merely produced 11 cosmopolitan species and in two places *Hyporhamma (Hemitrichia) serpula.* Bark from *Allocasuarina torulosa* in culture gave *Badhamiopsis ainoae*, *Hyporhamma velutina* and *Cribraria confusa. Terminalia sp.* gave *Stemonitopsis aequalis.* 17 separate Fitzroy bark collections were made, giving 79 cultures of which 14 produced myxomycetes.

Moving inland, the ground rises to 790m. at Atherton near which are some ancient fragments of rainforest, including Wongabel State Forest and Lake Eacham. Field collections at Wongabel gave 3 species, including Physarum didermoides and Hyporhamma leiocarpa. Wongabel bark from 15 trees produced 74 cultures of which 34 gave myxomycetes. Lake Eacham supplied bark from 6 trees producing 27 cultures of which 12 were productive. I assume the higher success rate compared to Fitzroy results from the lower rainfall. Interesting species from these cultures included *Clastoderma debaryanum* (both varieties), *Macbrideola scintillans* var. *verrucosa*, *Macbrideola martinii*, and *Arcyria minuta.*

Proceding further West the humidity drops much further. At Undara Lava Tubes cultures of bark from *Eucalyptus sideroxylon* produced a *Paradiacheopsis* resembling fimbriata but with a smaller spore and very robust capillitium with poorly developed flat tips. This was the only site where any quantities of *Echinostelium* other than *minuta* were common (*E. colliculosum).*

In my last week I collected in Mossman Gorge, then crossed the Daintree river and visited Cow Bay, Marrdja and sites further North. At the Cow Bay turnoff *Collaria arcyrionema* was found. Further North I twice found *Hyporhamma serpula*, but otherwise field collections gave only cosmopolitan species. As is normal with high humidity, bark culture was unproductive. 7 collections from Marrdja provided 28 cultures from which only one gave myxomycetes (*Licea scyphoides*).

8 trees from Cooktown Botanic Gardens were sampled for bark, giving 26 cultures of which 10 were productive. I obtained *Macbrideola martinii*, *M. scintillans* var. *verrucosa*, *Licea pedicellata* and, from *Diospyros hebecarpa*, *Licea tuberculata.*

Adding everything up, I obtained 60 taxa, 23 from field collections and 42 from bark cultures. 18 of these taxa were absent from Mitchell's 1995 paper. Bark was taken from 63 trees, giving 284 cultures of which 84 produced some myxomycete activity.

[Key note lecture – ECOL 1]

M. Meyer [1] **& J. Bozonnet** [2]

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Myxomycètes nivicoles

B 92 986

La notion d'espèce nivicole est due à Charles Meylan qui, fort de sa longue expérience de terrain, au début du XX^{e} siècle, a compris la nécessité d'un abondant et durable enneigement pour qu'apparaissent, au bord de la neige fondante, certaines espèces de Myxomycètes de plusieurs genres que l'on ne rencontre pas ailleurs, leur cycle se déroulant entièrement sous la neige. Il a retrouvé, dans les montagnes du Jura suisse surtout, plusieurs de ces espèces décrites avant lui et y a ajouté 21 taxons de ses propres récoltes. Le groupe des espèces nivicoles s'est enrichi ensuite grâce en particulier à D.T. Kowalski qui a créé 17 espèces, à partir de récoltes de la Sierra Nevada américaine et de la Chaîne des Cascades.

Dans le dernier quart du XXe siècle, c'est surtout dans les Alpes que les recherches vont se poursuivre en Autriche, en Italie et en France. Chez nous en Savoie, l'important enneigement de fin mars au début juillet, les relatives facilités de pénétration des massifs, de 900 à 2500 m d'altitude, ont permis de constituer des herbiers riches au total de 15 000 échantillons d'espèces nivicoles, et de décrire une douzaine d'espèces nouvelles.

L'importance de l'altitude est relativisée. Un classement des espèces selon les étages, les milieux végétaux, les supports est tenté. L'importance de la météorologie est signalée. Les régions du globe dans lesquelles ces espèces apparaissent, sont énumérées. Une liste est donnée des 82 taxons actuellement reconnus dans le monde comme nivicoles ainsi qu'une liste d'espèces non strictement nivicoles récoltées parfois près de la neige.

En conclusion, on examine ce qu'il serait possible d'attendre des cultures de spore à spore, de la MEB, des méthodes moléculaires, pour une plus grande connaissance des espèces nivicoles.

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[Key note lecture – TREN]

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Phylogenetic relationships of Myxomycetes inferred from nuclear and mitochondrial rDNA sequences

We have determined the phylogenetic relationships of key organisms grouped within the Myxomycota by comparing the sequences of portions of the genes for the nuclear and mitochondrial small subunit rRNAs. These sequences have been obtained using the polymerase chain reaction (PCR) and primers which specifically amplify these regions. We have obtained sequences from *Physarum polycephalum*, *Physarum didermoides*, *Didymium nigripes*, *Didymium iridis*, *Stemonitis flavogenita*, *Lycogala epidendrum*, *Lycogala flavofuscum*, *Echinostelium minutum*, *Ceratiomyxa fruticulosa*, and *Schenella simplex*. In addition we have used reverse transcription PCR (RT–PCR) to amplify cDNAs of the mitochondrial SSU rRNA. The DNA amplification products produced using these techniques were completely sequenced and these sequences have been aligned. Sequence alignments were used to produce a sequence difference matrix and in parsimony analysis to generate phylogenetic trees relating these organisms. Phylogenetic trees produced by either Distance Matrix or Maximum Parsimony methods using either mitochondrial or nuclear rDNAs were essentially congruent. Common features of these trees indicate that the lines leading to *Physarum*, *Didymium* and *Stemonitis* diverged from a common ancestor at about the same time while *Lycogala* and *Echinostelium minutum* diverged from this common ancestor more anciently. *Ceratiomyxa fruticulosa* is even more anciently diverged and may not be monophyletic with the other myxomycetes. Consistent with this, comparison of mitochondrial DNA sequences and the cDNAs derived from the corresponding mitochondrial RNA, revealed that all of the myxomycetes except *Ceratiomyxa fruticulosa* had RNA editing sites of the type characterized in *Physarum polycephalum*. Phylogenetic analysis of *Schenella simplex* indicates that it is more properly assigned to an anciently diverged monophyletic group of fungi than to myxomycetes. Comparison of myxomycete sequences with analogous sequences from other eukaryotes produces consistent trees in which myxomycetes diverge from the main eukaryotic line prior to the divergence of animals and fungi and at about the same time as *Acanthamoeba castellani* and the cellular slime molds such as *Dictyostelium discoidium*.

[Workshop – METH]

D. W. Mitchell

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Computers as tools for identification

There are currently 800 or so species of slime–moulds which have been formally described. Recent taxonomic additions and changes are scattered in various publications, some of which are often difficult to obtain. Morphological variation resulting from the influences of varying environmental conditions have led to some dubious new taxa being described in recent years and this has possibly, at least in part, been the result of the difficulties of access to descriptive works. A basis for Myxomycete taxonomy has recently been published by C. Lado (Nomenmyx, 2002) but no monograph providing descriptions of world species has been published since that of Alexopoulos & Martin (1969). The computer seems to be the way forward as a convenient way to bring information into one place and allow rapid access to diagnostic characters and provide keys for identification.

A range of software programmes will be used to demonstrate:

1. An Inventory of all–world Myxomycete taxa.
2. Synoptic Keys for identification of Myxomycetes to generic and specific levels.
3. Dichotomous keys to various ecological and taxonomic groups of Myxomycetes.

[Workshop – METH]

D. W. Mitchell

Walton Cottage, Upper Hartfield, Sussex, England, TN7 4AN, U.K.

Moist chamber techniques

D 92 913

Investigations into the biota of any region should be regarded as incomplete unless the Myxomycetes of bark, herbivore dung and plant litter are investigated. More than one third of the described spp. of slime–moulds are known to occur on the bark of living trees and other woody plants, many of which appear to be restricted to this substrate and then often to particular kinds of bark. Many of these corticolous species are among the smallest known Myxomycetes, their small size enabling them to sporulate rapidly in responce to short–term changes in the environment (i.e. High humidity or rainfall). The method of moist–chamber culture of such substrates provides conditions to stimulate sporocarp development and involves simple techniques that, providing that the investigator possesses a binocular microscope and the usual equipment for microscopic examination, limited expense is involved.

Items concerning this presentation will include:

1. Bark, leaf litter and dung as potential substrates for moist chamber culture.
2. Detailed methodology for the preparation of cultures and simple equipment required.
3. Harvesting and preparation of specimens as slide mounts and dried specimens.
4. Identification and recording of specimens.

[Workshop – METH]

D. W. Mitchell

Walton Cottage, Upper Hartfield, Sussex, England, TN7 4AN, U.K.

Photographic techniques

B 92 99

The practicalities of the following techniques will be discussed:

1. Optical vs. digital photography of small specimens.
2. Tips and tricks: Ways to increase depth of field problems in photomicrography.
3. Using computer software to emphasize fine structural detail and how to delete artifacts.

[Poster – FLOR 1]

D. W. Mitchell[1] & J. F. Stampfer[2]

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Some new and interesting Myxomycetes from Tanzania

[illegible]

A recent collection of tree bark and dung samples collected in the Arusha, Olmoti and Ngorongora regions of northern Tanzania produced some notable myxomycetes in moist chamber culture. Maps and photomicrographs of the specimens harvested will be presented.

[Lecture – ECOL 1]

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A study on nivicolous Myxomycetes. The genus *Lamproderma* I

B 92 992

The genus *Lamproderma* was proposed by Rostafinski in 1873 for species which had previously been referred to the genera *Physarum* or *Stemonitis*. Rostafinski gives a detailed description of the genus and places it within the tribe "Stemonitaceae".This genus is characterized by the globose, ellipsoid to subcylindrical sporocarps, usually stalked; thin peridium, persistent to partly evanescent, usually iridiscent; conspicuous columella, attaining from 1/3 to 2/3 the total height of the sporotheca; capillitium arising mainly from the tip of the columella, usually dark spores, which are also dark in the mass.

The basic general field work on nivicolous *Myxomycetes* was done by the Swiss investigator Charles Meylan, who made his collections mainly in the Jura Mountains in Switzerland. Meylan described 10 new species and 13 new varieties. We mention here seven of Meylan's species: *Lamproderma atrosporum*, *L. cristatum*, *L. echinosporum*, *L. fuscatum*, *L. ovoideum*, *L. pulchellum* and *L. splendens*. Many of his taxa have been rejected by later investigators and are treated simply as synonyms, partly due to the fact that Meylan gave only very short descriptions of his new taxa. Unfortunately Meylan never designated type specimens, which was not mandatory at the time. Therefore Kowalski (1975), in a revision of the Meylan collection, selected nomenclatural types for each species and variety described by him. Kowalski recognized 21 species of *Lamproderma* as distinct and valid (Kowalski, 1970) and described as new the species *Lamproderma acanthosporum*, *L. biasperosporum*, *L. disseminatum* and *L. maculatum*.

In recent times relatively few investigators have paid attention to this genus: Meyer, Poulain & Bozonnet in France and Neubert, Nowotny, Baumann & Schinner in Austria and Germany.

In this work we present 14 nivicolous taxa of the genus *Lamproderma* collected around melting snow banks in montane areas:

Lamproderma acanthosporum, *L. atrosporum* var. *atrosporum*, *L. atrosporum* var. *echinulatum*, *L. atrosporum* var. *macrosporum*, *L. cacographicum*, *L. cribrarioides*, *L. cristatum*, *L. cucumer*, *L. echinosporum*, *L. fuscatum*, *L. maculatum* var. *maculatum*, *L. maculatum* var. *macrosporum*, *L. ovoideum* and *L. pulchellum*.

Type material of species described by Meylan and Meyer was studied. Detailed descriptions accompanied by photographs of sporocarps and capillitia as seen with the light microscope, and SEM micrographs of spores and spore ornamentations are given. *Lamproderma atrosporum* var. *echinulatum* is synonymised with *L. atrosporum* var. *atrosporum*, *L. maculatum* var. *macrosporum* with *L. maculatum* var. *maculatum*, *L. cucumer* with *L. ovoideum*. The new variety *L. atrosporum* var. *pseudocribrarioides* is proposed.

[Poster – FLOR 2]

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Slime molds from the Greak Kobuk Sand Dunes (north–western Alaska)

B 92 993

During August–September 2000, samples of bark from living trees of *Picea glauca* (100 specimens) and *Salix alaxensis* (60 specimens), along with samples of grass litter (50 specimens), spruce cones (50 specimens) and the dung of herbivorous animals (60 specimens) were collected in the central Kobuk River Valley of northwestern Alaska and used to prepare a series of 310 moist chamber cultures. Fourty–one species of slime molds (*Myxomycetes*) representing 20 genera were identified from 70 field collections and from collections obtained from the 310 moist chamber cultures. Prominent examples include a new record (*Diderma evelinae*) for North America; several new records (*Echinostelium brooksii*, *Physarum famintzinii*, and *Badhamia cinarescens*) for Alaska; and a number of records (*Arcyria denudata*, *Diderma spumarioides*, *Didymium nigripes*, *Hemitrichia abietina*, *Lamproderma columbinum*, *Licea parasitica*, *Physarum leucopus*, *Ph. nutans*, and *Wilkomllangiella reticulata*) for western Alaska. *Echinostelium brooksii* and *Enerthenema papillatum*, two species reported previously as typically associated with acidic bark, were common on the bark of *Picea glauca* (mean pH 4.35 ± 0.37) collected from coniferous woodlands of the Kobuk Valley. The number of species (14) recorded from coarse woody debris was higher than the totals recorded from the bark of living trees and shrubs (8), leaf and grass litter (7), and living mosses (5). Data for dung are not yet complete, because some samples (moose and porcupine) have yet to be examined. *Perichaena vermicularis* (35 records) and *P. quadrata* (22 records) were clearly the dominant species present on the decaying spruce cones. The main dung–inhabiting species were *Physarum bivalve* (31 records) and *Leocarpus fragilis* (18 records).

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[Lecture – FLOR 2]

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Myxomycete biodiversity of the Colorado Plateau (USA) and the Caspian Lowland (Russia)

B 92 444

Aim. The primary objective of the research reported herein was to obtain data on the distribution and ecology of myxomycetes in the arid areas of the Colorado Plateau (southern–western United States) and steppe and desert areas of the Caspian Lowland (southern–western part of Russia).

Methods. The moist chamber culture method was employed regularly, using substratum samples (bark, litter, herbivore dung). pH of the substratum was measured with a flat surface electrode. Shannon's diversity (H'), Soerensen similarity (Cs) coefficient, Simpson's heterogeneity index (D) and mean number of species per culture (MSC) were used to compare the assemblages of myxomycetes in different vegetation types and substrates.

Results. In the Colorado Plateau (CP) 90 taxa were identified from 1172 records originated from 433 moist chamber cultures and 21 records of 10 species from field collections. In the Caspian Lowland (CL) 103 taxa were identified from 2337 records from 1551 cultures and 818 records of 111 species as field collections. Only 18 species had a frequency of occurrence higher than 1.5 % in moist chamber cultures in the CP and 16 species in CL. Consequently, only a comparison of species richness for the same substratum type can reflect the true abundance relationships, for example in CP for bark–inhabiting assemblages the species diversity increases from sage–brush desert (8 species, 50 records, MSC=2.94 ± 0.28, H'=1.86, D=0.17) to pinus–oak–juniper woodland (48 species, 310 records, MSC=3.68 ± 0.27, H'=3.44, D=0.05). In both study areas the main bark–inhabiting species (> 2% of constancy) were *Comatricha laxa*, *Macbrideola oblonga*, and *Physarum decipiens*. The bark–inhabiting species with high level of constancy *Macbrideola declinata* (7 % of cultures), *Echinostelium coelocephalum* (5 % of cultures) for CP were not found in CL; the main litter–inhabiting species *Didymium mexicanum* (5 % of cultures), *Badhamia gracilis* (4 % of cultures, mainly on decaying part of *Opuntia* sp.) were not found in CL; the main coprophilous species in both study areas were *Badhamia apiculospora*, *Fuligo cinerea*, *Perichaena liceoides*, and *Licea tenera*.

Main conclusions. The myxomycete biotas of the two study areas have high level of similarity (Cs=0.74) differing considerably from temperate (mean Cs=0.34), boreal (mean Cs=0.49) and tropical biotas (mean Cs=0.42).

This study was supported by grants 02–07–90439, 02–04–49907, RSF. We are grateful to Dr. J.F. 'Ted' Stampfer for providing the visit of the first two authors to the Colorado Plateau and to conduct field work in Arizona and New Mexico in 1999.

[Lecture – SYST]

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Les espèces du genre *Lepidoderma*

B 92 9

Nous proposons une révision du genre *Lepidoderma*.

– Un premier groupe réunit les espèces nettement stipitées, non nivicoles: *L. tigrinum* (Schrad.) Rostaf. et *L. crassipes* Flatau & *al.*

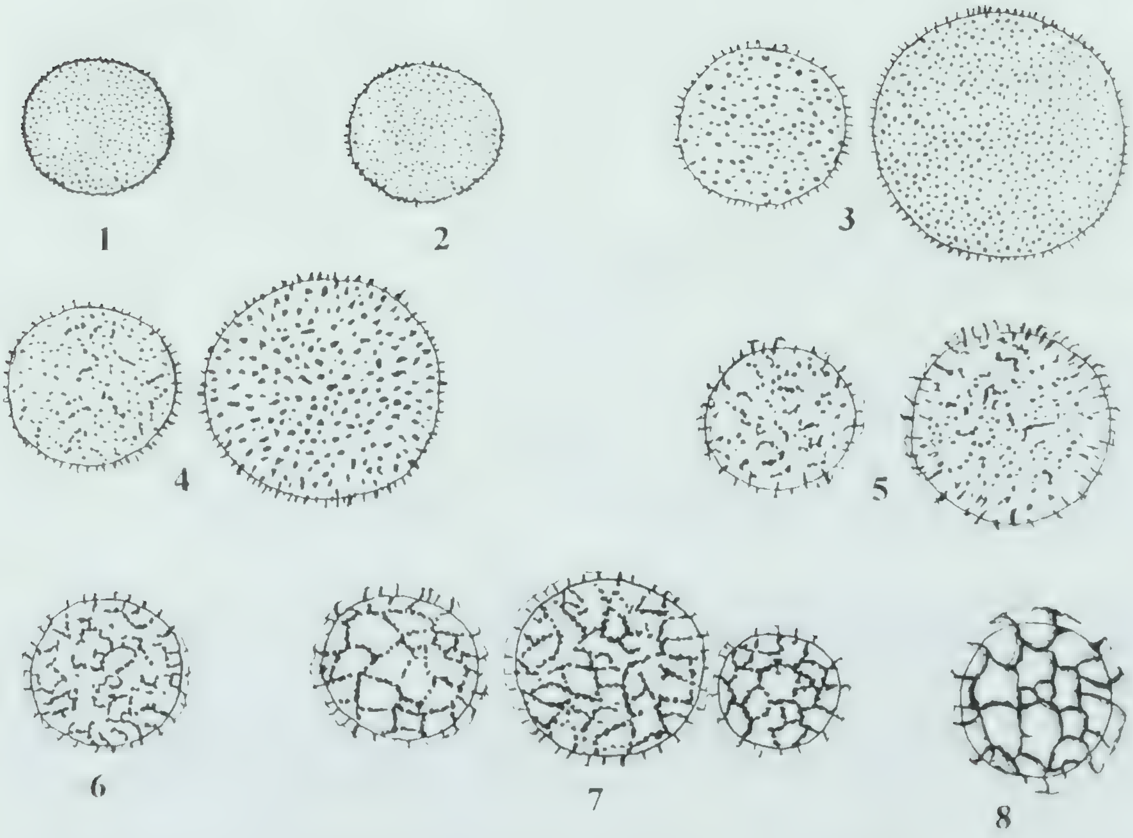
– Le deuxième groupe est constitué d'espèces nivicoles, sessiles, sporocarpes ou plasmodiocarpes, d'une part *L. carestianum* (Rabenh.) Rostaf., *L. granuliferum* (Phill.) R.E. Fries et une espèce nouvelle *L. perforatum* Meyer & Poulain, d'autre part *L. chailletii* Rostaf., *L. aggregatum* Kowalski et une espèce nouvelle *L. alpestroides* Meyer & Poulain.

L'examen du type de *L. carestianum* a permis de montrer que cette espèce n'était pas synonyme de *L. chailletii*.

– Le troisième groupe comprend deux anciens *Diderma* à péridium triple dont la couche médiane est constituée d'écailles calcaires cristallines:

1. Lepidoderma trevelyani (Grev.) Poulain & Meyer *comb. nov.*
≡ *Leangium trevelyani* Grev.
≡ *Diderma trevelyani* (Grev.) Fr.
2. *Lepidoderma peyerimhoffii* Maire & Pinoy 1926
≡ *Diderma peyerimhoffii* (Maire & Pinoy) Neubert & *al.*
= *Diderma trevelyani* var. *nivale* Meyl.
= *Diderma nivale* (Meyl.) Nowotny & *al.*

7 dessins de spores



1 *M. subcylindricum* (Meylan) ad. int. 2 *M. nigricapillitium* (Nann.- Bremek. & Bozonnet) ad. int
3 *M. aggregatum* ad. int. 4 *M. spinulosporum* ad. int. 5 *M. echinulatum* (Meylan) ad int
6 *M. atrosporum* (Meylan) ad. int. 7 *M. atrosporum* var *retisporum* ad. int
8 *M. pseudocribrarioides* ad. int

[Lecture – ECOL 1]

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Lamproderma nivicoles du groupe *atrosporum* Meylan

Nous exposons brièvement notre conception de l'espèce considérée comme un morphotaxon.
Lamproderma atrosporum a été créé en 1910 par Charles Meylan qui, suite à de nombreuses récoltes, remarque la variabilité de l'espèce et décrit deux variétés et une forme.
L'expérience de terrain de Marianne Meyer et Jean Bozonnet, confirmée par l'étude au microscope optique, a permis de distinguer, à partir de plusieurs caractères morphologiques, six espèces nivicoles, bien reconnaissables, correspondant chacune à de nombreuses récoltes provenant de divers lieux de France, et plus rarement de l' étranger, et conservées dans nos herbiers.
D'autre part, ce complexe «*atrosporum*» occupant une position marginale au sein des *Lamproderma*, celle-ci proche des *Comatricha*, nous proposons de réunir ces espèces dans un genre nouveau: le genre *Meriderma* (du grec: meris: morceau, fragment et derma: peau.)
Ce genre serait caractérisé par:
– le péridium précocement fragmenté,
– le capillitium très foncé (brun fuligineux à presque noir), réticulé, naissant sur presque toute la longueur de la columelle, avec de nombreuses extrémités libres fréquemment en forme d'entonnoir qui retiennent des restes de péridium.
– la masse des spores très foncée ou noire,
– l'habitat nivicole.

Le complexe *L. atrosporum* Meylan serait scindé en 6 espèces:
Meriderma atrosporum, *M. aggregatum*, *M. echinulatum*, *M. spinulosporum*, *M. pseudocribrarioides*, *M. subcylindricum*.
L. nigricapillitium Nann.-Bremek. & Bozonnet, dont la synonymie: *Comatricha nigricapillitia* (Nann.-Bremek. & Bozonnet) Castillo, Moreno & Illana, *Collaria nigricapillitia* (Nann.-Bremek. & Bozonnet), Lado montre bien l'indécision quant à sa position générique, serait également versé dans ce genre.
Nous commentons la clé du genre *Meriderma*.
Nous présentons enfin trois autres espèces à péridium «méridermoïde»:
Comatricha anastomosans Kowalski, *Enerthenema intermedium* Nann.-Bremek. & Critchfield, *Lamproderma fuscatum* Meylan, en insistant sur les caractères les excluant du nouveau genre.

[Poster – FLOR 1]

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The effect of vegetation on the distribution of Myxomycetes on a tropical mountain

B 92 997

In the tropics, altitudes compensate for latitude and one finds a montane temperate climate at high elevations. In these hill stations rainfall is seasonal as elsewhere in the tropics, and the monsoon is more prolonged than in plains. The rainfall is much higher than in the temperate zone but the temperatures remain low, and the summer and winter are dry. On the whole, this is the climate that is most conducive for Myxomycetes in the tropics.

A brief but intensive investigation of the distribution of myxomycetes was made in two contrasting vegetational types in a hill station located on the range of mountains known as the Western Ghats in Southern India, using standard ecological methods. One was an artificial pine forest and the other, a specific type of evergreen forest known as *shola*.

The myxomycete flora of the two vegetational types differed widely, with only 20 common species out of a total of 80 species collected, and a community coefficient of 0.35. The species richness and diversity were much higher in the shola forest, with 63 species as against 37 in the pine forest. The four major Orders were well represented in the shola forest whereas the Physarales were low in the pine forest. Within each forest type there were seasonal variations in the distribution of species.

The age of the forest, density of vegetation and species diversity, and the presence of a thick layer of broad–leaved litter, all contributing to a more favourable microclimate and a wider range of substrates in the shola forest, were regarded as the factors influencing the species richness in this type of forest.

[Lecture – TREN]

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A cladistic analysis of Myxomycetes based on an exploratory survey of morphological characters

Myxomycetes (plasmodial slime moulds), previously among protoctists, are now placed as sistergroup to animals + fungi. Their holotrophic nutrition and mobility resemble animals. Their fruiting bodies and meiospores are like those of fungi. Their amoeboid flagellated stage is shared with some other protoctistian–like groups. Their own peculiarities add to a controversial placement. Currently, the eumycetozoans has been recognized as a monophyletic group to include the Myxomycetes (or Myxogastria), Protosteliomycetes (or Protostelia) and Dictyosteliomycetes (or Dictyostelia) on the basis of SSrDNA and EF–1a sequences. However, there is no phylogenetic analysis to evaluate the monophyly of each of these three Classes. Our goal is to determine if Myxomycetes is a monophyletic group as currently classified to include the orders: Ceratiomyxales, Liceales, Echinosteliales, Trichiales, Physarales and Stemonitales. Fourty–four morphological and ultrastructural characters were studied in thirty species from the six orders. Seven additional taxa represented protostelids, dictyostelids, chytridiomycetes and Glomalean fungi as outgroups. We studied character variation in features of sporotheca, stalk, amoeboid stages, and flagellar position, among others. Cladistic analyses were executed in PAUP4.0b10 using a three step heuristic search. First we did a fast search to quantify an upper limit for tree length. Then we implemented 100 replicates (random taxon addition, mulpars=on, TBR) but saving only 30 trees above such length limit (s=88) to avoid swapping on multiple trees from the same island. These trees were used in a full heuristic search without limits using mulpars and the TBR swapping algoritms. Our heuristic analyses of 37 taxa found 5953 trees (s=88, CI=0.682, RI=0.826). The strict consensus recovers a clade with the 30 exemplars of the Myxomycetes. This monophyletic group is supported by the following synapomorphies: phaneroplasmodium, absence of stalks, and apofisis absent. The three species representing the Ceratiomyxales form a basal clade, but the other five orders are not recovered. These preliminary analyses suggest that the Myxomycetes are monophyletic and that the protostelids are their closest sistergroup. The Dictyosteliomycetes are in turn the sistergroup of Myxomycetes + Protosteliomycetes. Next studies will survey additional representatives and characters from Liceales, Physarales and Stemonitales.

[Poster – ECOL 1]

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Snowbank myxomycetes from West Virginia

A distinctive ecological group of myxomycetes is associated with the melting snowbanks that occur during late spring and early summer in alpine regions of the Temperate Zone. The species that occupy this rather special and very limited microhabitat are usually referred to as "snowbank" or "nivicole" myxomycetes, since they produce fruiting bodies only during the relatively brief period of time when the special microenvironmental conditions associated with melting snowbanks and apparently required for their growth and development exist. Snowbank myxomycetes are particularly well known from the mountains of western North America. However, with the exception of a single collection of *Prototrichia metallica* from the Great Smoky Mountains, we are not aware of any previous records of the group in the central and southern Appalachians. In late May of 1999, two additional species (*Lamproderma sauteri* and *Lepidoderma carestianum*) were collected from dead fern litter near a small snowbank at the Snowshoe Ski Resort (elevation 1475 m) in Pocahontas County, West Virginia. The snowbank represented the last remnant of a snowfield that had been created artificially during the winter ski season at the resort. Both species are among the most common snowbank myxomycetes encountered in the mountains of western North America. It seems likely that these and possibly other snowbank species could occur in similar situations elsewhere in the central and southern Appalachians, especially since visits to the Snowshoe Ski Resort in May of 2000 and 2001 yielded several more specimens of the same two species collected in 1999.

[Poster – ECOL 1]

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Nivicolous myxomycetes from Sierra Nevada National Park (Spain)

The National Park of Sierra Nevada is located in the south of the Iberian Peninsula, in Granada and Almeria provinces with an area of 86.208 hectares. Since 1986 it is Reserve of the Biosphere and it was declared National Park in 1999 owing to its geological interest, its very fragile biological richness due to the critical environmental conditions, and to emphasize the mountain and high mountain flora of the Mediterranean Region.

Sierra Nevada is an area characterized for having the tallest peaks of the Iberian Peninsula, the Mulhacen (3.482 m) and Veleta (3.392 m). Its formation was generated in a compressible process during the Alpine folding. Large slipping mantles and metamorphic rocks paleozoic age are the main geological components of Sierra Nevada. The typical modeled glacier appears in its highest peaks.

Sierra Nevada is an exceptional refuge for the biodiversity in European continent. It presents the richest and most varied flora in all the western Mediterranean region with a total amount of 2.100 superior plants, which have already been described and which represents one third of the whole Spanish flora. We must also take into account that 176 of these plants are Iberian endemic species and 66 are only found in Sierra Nevada.

This floristic richeness is due not only to its own geologic history but to a great variety of environmental factors such as climate, orography, geography, etc. From the biogeographic point of view, it has a strategic location, owing to its situation in the western Mediterranean region as well as its relative geographic isolation. All this combined with the diverse ecological factors have favoured the speciation processes. Due to this Sierra Nevada has been studied by numerous botanists as Boissier and Willkomm to mention some of them.

Over the 2.800–2.900 ms of altitude the snow is present during about 9 months a year. The characteristic vegetation is the psyceroxerophytic grasslands, formed by species of low height (*Arenaria nevadensis, Erigeron frigidus, Festuca indigesta, Narcisus nevadensis*) the majority endemic. To this altitude the movable rocky places are abundant, where species adapted to the continuous displacement of stones live by means of the development by long roots.

When lowering in altitude, between 1.900 m and 2.900 m the landscape changes. The communities of piornal (*Juniperus communis* subsp. *nana, Juniperus sabina* and *Genista versicolor*, etc) become dominant. These scrubs serve as refuge to numerous animal species. To these altitudes, surrounding streams and lagoons of high mountain, appear the hygrophilous grassland which are known as "borreguiles" formed by exclusive endemic, central European and Iberian–northafrican species viz *Plantago* *nivalis*, *Luzula nevadensis* or *Nardus stricta*.

From May to August in 2001, we made several botanical forays with the purpose of collecting nivicolous myxomycetes in the highest zones of Sierra Nevada when melting snow.

At the moment the identified species are: *Comatricha anastomosans* cf., *Diderma alpinum*, *D. nivale*, *Didymium dubium*, *D. nivicolum*, *Lamproderma atrosporum* var. *atrosporum*, *L. atrosporum* var. *pseudocribrarioides*, *L. echinosporum*, *L. maculatum*, *L. ovoideum*, *L. sauteri*, *L. splendens*, *Lepidoderma carestiae*, *L. granuliferum*, *Physarum albescens*, *P. alpinum* and *P. vernum*.

Although these references are not the ones from Sierra Nevada, they are certainly the first references known on nivicolous myxomycetes in this area, except for the record of *Diderma niveum* (Ortega & Calonge 1980).

[Key note lecture – FLOR]

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Global patterns in myxomycete diversity – recent advances and remaining problems

B 93 001

For any group of organisms, biogeographical studies depend strongly upon the reliability of the underlying taxonomical concept. For myxomycetes, it can be estimated that only about 40% of the ca. 1000 taxa are relatively well known (i.e., recorded from more than 20 localities). This low proportion reflects not only the disadvantages inherent to the current morphological species concept but also the lack of generally accepted standards for the description of new species. A second constraint to obtaining data on myxomycete distribution is the degree of completeness of local species inventories. Statistical methods have demonstrated that even the most comprehensive local surveys are only complete to 70–90%. A still fragmentary world map of myxomycete diversity, compiled from a number of regional checklists and fairly complete local surveys, seems to show a "reverse" pattern of diversity in this group of organisms, with the "hot spots" or diversity located outside tropical moist forests, well known as regions of vascular plant megadiversity.

Preliminary distribution maps developed for three species of myxomycetes provide evidence for global yet distinct ranges as the situation to be expected for most myxomycetes, which appear to be limited more by microhabitat availability than by macroclimate. Since long–distance dispersal of myxomycete spores may produce rare records under exceptional weather conditions outside of the natural range of a particular species, abundance data seem to be indispensable for revealing the true patterns of myxomycete diversity on the earth.

[Lecture – MORF]

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The evolution of the myxomycete fructification – an independent approach of life to achieve macroscopic organisms?

B 93 002

Several non– or only distantly related groups of organisms share some of the biological characteristics of myxomycetes: predators of other micro–organisms, no active life stage forming tissues or cell walls, and, most notably, the development of fruiting bodies presenting spores for long–distance dispersal. Myxobacteria, Acrasiales, Dictyosteliales, Protosteliales and the Ciliate genus *Sorogena* are examples of these "myxomycete–like" organisms.

To investigate possible evolutionary limitations of this life form, a simple fructification model consisting of a conical stalk and an ellipsoid sporotheca was constructed. The respective measures were taken from mounted slides or published images of more than 300 specimens throughout myxomycete–like organisms. As to be expected, almost always more than 80 % of the total resources (expressed in terms of volume) were used in the production of the sporotheca. As one can consider by looking at a water tower with a spherical reservoir, the cross–section of the tower should be proportional to the weight of the water in the reservoir to stabilize the construction. Indeed, myxomycete–like organisms conformed to this model. Using the mean proportionality factor found, an iteration programme was written to calculate maximum possible stalk length for a certain total volume and percentage of resources allocated to sporotheca volume. Over a range of values for total volume from 10^{-6} mm^3 (Protostelids) to about 10^{-1} mm^3 (small myxomycetes), the respective graphs run parallel to each other, showing a strong decrease in achievable sporotheca size above a certain stalk length. For larger total volumes, the graphs clustered together for biologically meaningful proportions of resources allocated to the sporotheca (above 80%). A comparison with the measurements from real specimens showed that the sporocarps of most species of stalked myxomycetes were located exactly at this point, indicating a resource–driven limitation for the size of the fructifications.

The model explains the observation that the relationship between stalk length and sporotheca volume levels off at lengths between 1 and 3 millimetres, and these limitations are adhered to in nature, when large phaneroplasmodia separate into numerous small sporocarps for stalked myxomycetes. As indicated by several cases of independent evolution among prokaryotes and early eukaryotes, the fructifications produced by myxomycete–like organisms may represent one way, perhaps among the very first to appear, of producing macroscopic structures in life. However, the mechanical limitations of these structures caused them to lose the competition with the tissue–based structures that evolved in other life forms.

[Lecture – ECOL 3]

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Myxomycetes from inflorescences of giant herbs and foliicolous liverworts B 93 003

In humid tropical forests, where substrata on the forest floor rarely dry out completely, many myxomycete species seem to prefer aerial habitats. This talk presents two new myxomycete assemblages, the first from inflorescences of giant monocot forbs and the second from liverworts covering living leaves of understory plants.

Inflorescences of various species of *Heliconia* and *Costus* where found to be regularly inhabited by myxomycetes in Costa Rica, Ecuador, and Puerto Rico. From 652 specimens of myxomycetes collected in the field or obtained from 358 moist chamber cultures prepared with decaying floral parts, 33 myxomycete taxa were recorded. A comparison with the results from 696 cultures prepared with other litter substrata showed that 13 taxa preferred inflorescences. Six taxa seem to be specialized for this microhabitat; three of these (*Perichaena dictyonema*, *Physarum superbum*, and an apparently undescribed Physarum morphologically similar to *Physarum limonium*) are new records for the Neotropics. Rapidly decaying floral parts and nectar remnants enclosed by massive, still living bracts seem to nourish a rapidly developing community of yeasts and bacteria, as indicated by a high density of myxobacteria. Canonical correspondence analysis suggested that plants with massive, compact inflorescences characterized by a pH between 8 and 9, growing at lower elevations and in localities with moderate annual rainfall provide optimal conditions for the myxomycetes. An incidental dispersal of spores by pollinating or frugivorous birds seems possible and may account for the high frequency of some of these "floriicolous" myxomycetes.

At the same localities, foliicolous liverworts were screened for the presence of myxomycetes using the moist chamber culture technique. Eleven taxa were recorded, with *Arcyria afroalpina* as a new record for the Neotropics. Three species (*Arcyria cinerea*, *Didymium iridis* and *D. squamulosum*) appeared with a high frequency (between 59 and 66%) in the moist chamber cultures. Unusually small numbers of sporocarps found in the cultures, along with the occurrence of atypically small sporocarps suggest a microhabitat poor in nutrients. In contrast to inflorescences, none of the morphologically defined taxa seems to be specialized for this microhabitat, which may instead work like a reservoir for a number of litter–inhabiting myxomycetes. Lowland rain forests with a high annual rainfall seem to provide the best conditions for these myxomycetes, which constitute a new addition to the group of organisms making up the community of epiphyllous cryptogams. (This research was supported in part by a grant [DEB–9705464] from the National Science Foundation).

[Key note lecture – FLOR 2]

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Are there northern distribution limits for myxomycetes?

A compilation of 12 fairly complete local surveys of myxomycetes, encompassing almost 2000 specimens, in northern boreal and arctic regions showed relatively stable but species–poor assemblages to be the general pattern. For the whole study, 150 myxomycete taxa were recorded, but only 41 of these had a frequency of occurrence higher than 1 % either in moist chambers or as field collections. Only 33 taxa were found to be widely distributed (recorded from at least five study areas) and thus can be expected to occur regularly at high northern latitudes.

Interestingly, the northern most locality considered, the Taimyr Peninsula (71° 30' N), produced one of the highest numbers of species (48), with a number of these not found in the other surveys. This region has the most continental climate of any of the study areas considered and the northernmost forests on earth. Compared with temperate regions, a higher proportion of species belonging to the Trichales but lower proportions from the orders Stemonitales and Liceales were found in arctic regions.

A simple ordination of substratum preferences of the species recorded reveals litter and coarse woody debris as the main microhabitats for field–collected myxomycetes. Moreover, there is a surprisingly rich biota of bark–inhabiting species in relation to the low number of tree taxa. Nivicolous taxa appear to be rare in northern regions and members of the group seem to be limited largely to montane situations.

Many wood– and bark–inhabiting taxa can inhabit fairly small woody stems and extend as far north as shrubs occur. Litter species seem to be affected more by the low pH values of this substratum type in northern regions, as it is also the case for coprophilous myxomycetes. Although a few litter inhabitants (e.g., *Mucilago crustacea* or *Trichia munda*) were found to be surprisingly common in comparison with temperate zones, arctic regions seem to lack specialized myxomycetes.

[Lecture – ECOL 2]

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Vertical distribution and assemblages of corticolous myxomycetes on five tree species in the Great Smoky Mountains National Park

Corticolous myxomycetes of the Great Smoky Mountains National Park were studied in relation to their association with certain tree species and height of occurrence in the tree canopy. Using the double rope climbing method, bark was collected at three–meter intervals to the tops of five different tree species and cultured using the moist chamber technique. The bark of 25 trees was cultured for 4 weeks resulting in 418 cultures. Bark factors including tree species, pH, height in tree and water holding capacity were analyzed as to their relationship to the myxomycete assemblages cultured in moist chambers. Results suggest that myxomycete community composition among selected tree species is similar, but occurrence and abundance of certain species are related to differences in bark pH. Community similarity values between trees of different species show that trees with the most similar myxomycete communities also have the most similar bark pH. Most common myxomycete species in this study show a pH preference. No variation in species richness was detected at different heights in the canopy, and most species were obtained at all heights, up to at least 24 meters. The water holding capacity of the bark could not be correlated with species richness or abundance of myxomycetes that inhabit the bark of living trees. This is the first study to characterize myxomycete communities of tree canopies. Eighty–four myxomycete species were identified, including 30 species not previously known to occur in the park. This research project is funded by the National Science Foundation, Division of Environmental Biology, Biotic Surveys and Inventories Program, Award # DEB–0079058 and Discover Life in America Award #2001–26.

[Lecture – FLOR 1]

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Hawai'i, a microcosm for predicting the distribution of Protostelids in the tropics

D 93 006

Very few surveys of the protostelid biota have been published for the tropics. Most of the work that has been published has focused on rainforests. The data from these studies suggest that protostelids may be less common in tropical rainforests than they are in temperate habitats. The question arises: Are rainforest biotas of protostelids typical of all tropical biomes, or do different tropical biomes support different protostelid biotas? The Island of Hawai'i is an ideal microcosm of the tropics in which to address this question. It is located between approximately 18° 55' N and 20° 15' N and covers just over 10,400km^2. Its altitude ranges from sea level to over 4000m. Precipitation ranges from under 25 cm/yr to over 600 cm/yr. In addition, the island is subject to both anthropogenic disturbance and frequent volcanic disturbance. Finally, the island has an infrastructure that allows relatively easy access to all habitat types. Thirty of the 32 described species of protostelids as well as numerous undescribed species occur on Hawai'i. It is likely that most species will occur in any habitat if enough collections are made. However, more species per collection and more colonized substrates per collection occur in mesic and dry native habitats than in wet native habitats. Within native wet habitats, the protostelid biota becomes more depauperate with increasing altitude. If the situation in Hawai'i is typical for protostelids, then it is predicted that, in general, tropical mesic to dry habitats would have a richer biota than tropical rainforests. Preliminary results from a collecting survey in Puerto Rico appear to support this hypothesis.

[Lecture – FLOR 1]

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Comparative biota of Protostelids of Hawai'i and Puerto Rico

The Island of Hawai'i and the Puerto Rico are both islands that have never been in contact with a major continent. They are found at roughly the same latitude and are close in size. They share a number of similar habitats although Puerto Rico lacks the high altitude habitats found in Hawai'i. An early study of Puerto Rican rainforests in showed that they have a relatively depauperate protostelid biota. This was confirmed for native Hawaiian rainforests. However, Hawaiian mesic and dry forests have a very rich protostelid biota. A preliminary survey of mesic and dry forests in Puerto Rico shows that protostelid biotas are richer than Puerto Rican rain forests, especially higher altitude rain forests. Species by species comparisons show the following. With respect to the more common species found on both islands, *Protostelium mycophaga*, *Schizoplasmodiopsis pseudoendospora,* and *Soliformovum irregularis* are more common in Hawai'i than Puerto Rico. Conversely, *Nematostelium irregularis* is more common in Puerto Rico. For slightly less common species, *Cavostelium apophysatum* is more common in both Puerto Rico and Hawai'i than it is at higher latitudes while almost no occurrences of *Protosporangium* spp. were found in Puerto Rico while they are not uncommon in Hawai'i. In conclusion, the pattern of the richest biotas in mesic forests holds for both islands. However, the patterns of individual species differs.

[Key note lecture – ECOL 3]

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Special microhabitats for myxomycetes

Decaying coarse woody debris, dead leaves and various other types of plant litter, and the bark surface of living trees are generally considered as the primary microhabitats for myxomycetes. These organisms can, however, also be found in a number of other special microhabitats. For example, in tropical and temperate rain forests, where the trunks and larger branches of trees are characterized by the presence of numerous vascular and nonvascular epiphytes, a "canopy soil" develops at the base of or beneath mats of these plants. Myxomycetes have been recovered from this microhabitat, but almost nothing is known about the taxa involved or their ecology. Myxomycetes have been reported from "true" soils by a number of workers, and large clones of certain species of *Didymium* apparently occur in some forest soils. One example from the mountains of West Virginia extended over a total area of at least 1.3 km^2 and was isolated from soil samples in each of three different years. Some plant parts, as a result of their structure, can serve as "natural moist chambers" for myxomycetes. Such is the case for the basal leaf sheath of certain palms. In montane coniferous forests of the Northern Hemisphere, a few species (e.g., *Barbeyella minutissima*) appear to be restricted largely to a substrate complex represented by the decaying wood of decorticated spruce (*Picea* spp.) logs with a cover of leafy liverworts present. In some high–latitude tundra and tundra–like regions of the world, deposits of peat can develop under certain environmental conditions. The peat can serve as a substrate for myxomycetes, including some lignicolous species. Although myxomycetes are generally regarded as completely terrestrial organisms, a number of examples are not uncommon in wetlands such as bogs and marshes, and a few species have been recovered from truly aquatic situations. (Supported in part by a number of grants from the National Science Foundation, the USFA Forest Service, and the National Geographic Society).

[Poster – ECOL 3]

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Myxomycetes associated with decaying fronds of nikau palm in New Zealand

D 93 009

Nikau palm (*Rhopalostylis sapida*) is one of the more characteristic small trees of lowland forests throughout much of the northern half of New Zealand. The leaves (commonly called fronds) of this plant are rather large, and the base of the petiole is expanded to form a sheath where it is attached to the stem. After abscission occurs and the fronds fall to the forest floor, the edges of the sheath become convoluted, creating a more–or–less enclosed space that appears to function as a "natural moist chamber" for myxomycetes. Such microhabitats examined during the course of fieldwork carried out in New Zealand during the period of 1992–2001 often yielded collections of myxomycetes when all other substrates at the same locality were non–productive. At least 35 species in 13 genera were represented among the >260 collections from decaying fronds of nikau palm considered in the present study. The vast majority (99%) of these are members of the Physarales or Trichiales. *Didymium squamulosum* was the single most abundant species (>30% of all collections), but *Trichia favoginea*, *Physarum pusillum*, and *Perichaena depressa* also were relatively common (with each represented by >5% of all collections). Among the other myxomycetes recorded from nikau palm were a number of species not previously known to occur in New Zealand or known from only one or two collections. Prominent examples include *Badhamia gracilis*, *Craterium aureum*, *Physarum hongkongense*, and *P. pezizoideum*. (Supported in part by two grants from the National Geographic Society).

[Lecture – FLOR 2]

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Myxomycetes of the New Zealand subantarctic islands

McKenzie and Foggo, who reviewed all previous records of fungi collected on the New Zealand subantarctic islands, listed only two myxomycetes (*Trichia favoginea* from the Auckland Islands and *Lamproderma echinulatum* from the Snares Islands). During a survey of fungal biodiversity carried out on Campbell Island for a two–week period (March 6–18) in 2000, the types of substrates upon which these organisms typically occur were investigated for the presence of myxomycete fruiting bodies that had developed under field conditions. In addition, samples of various kinds of dead plant material were collected. Later, these samples were placed in moist chamber cultures of the type used for the laboratory isolation of myxomycetes. Although the primary focus of the survey was on the fungi of Campbell Island, an opportunity to spend several days (March 20–23) on the Auckland Islands yielded a number of field collections of myxomycetes. At least 31 species in 17 genera were represented among the specimens obtained as a result of the entire survey. This total included 11 species recorded from moist chamber cultures and 24 species represented by field collections. These records included the southernmost known occurrence of such species as *Arcyria leiocarpa*, *A. major*, *Badhamia nitens*, *Lamproderma columbinum*, and *Trichia erecta*. (Supported in part by grant DEB–9971695 from the National Science Foundation).

[Poster – FLOR 2]

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Myxomycetes associated with subalpine coniferous forests in the Great Smoky Mountains National Park

Subalpine coniferous forests dominated by red spruce (*Picea rubens*) occupy higher peaks and ridges in the Great Smoky Mountains National Park. During the 1999, 2000, and 2001 field seasons, the assemblages of myxomycetes associated with these communities have been studied as part of the All Taxa Biodiversity Inventory (ATBI) currently being carried out in the Park. At least 49 species in 25 genera have been identified from the more than 225 field collections obtained thus far. Among these are several species that appear to be restricted largely to subalpine coniferous forests and are rarely if ever collected in the forests found at lower elevations in the Park. Prominent examples include *Barbeyella minutissima*, *Colloderma oculatum*, *Elaeomyxa cerifera*, *Lamproderma columbinum* and *Lepidoderma tigrinum*. All five species tend to be associated with a substrate complex represented by the decaying wood of decorticated spruce logs with a cover of leafy liverworts (particularly *Nowellia curvifolia*) present. A number of other myxomycetes, including *Cribraria rufa*, *Diderma roanense* and *Trichia erecta*, seem to have distributions centered in subalpine coniferous forests. (Supported in part by a grant from Discover Life in America).

[Lecture – FLOR 2]

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All taxa biodiversity inventory in the Great Smoky Mountains National Park

D 93 -42

An All Taxa Biodiversity Inventory (ATBI) is currently underway in the Great Smoky Mountains National Park in the southeastern United States. The ultimate objective of this project, which is likely to extend over a period of at least 10 to 15 years, is to carry out a comprehensive inventory of all life forms in the Park. Prior to the ATBI, 92 different species of myxomycetes had been reported from the Park, and the majority of these records were based upon specimens collected more than a half century ago. In the past three years, more than 100 species have been added to this total. Although the number of species now known from the Park is as high or higher than those reported for other comparable regions of the world, it is anticipated that there are many more species to be found. In fact, based upon the results obtained thus far, the Great Smoky Mountains National Park appears to be one of the world's "hot spots" for myxomycetes, with as many species present in the Park as anywhere else on earth. Biodiversity of dictyostelids and protostelids also seems to be relatively high. A number of individuals, including James Cavender, Harold Keller, John Landolt, Roland McHugh, David Mitchell, Yuri Novozhilov, Wayne Rosing, Fred Spiegel, and Martin Schnittler, have collected and studied mycetozoans in the Park, and the opportunity certainly exists for others to become involved in the ATBI. (Supported in part by a grant from Discover Life in America.)

[Key note lecture – FLOR 1]

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Studies of Neotropical Myxomycetes

0 32 043

During the period of 1997 to 2001, as a result of funding provided by National Science Foundation grant DEB–9705464, a biotic survey of myxomycetes was carried out in a number of study areas in Central and South America to document more completely the species associated with tropical forest ecosystems in this region of the world. More limited data were obtained for dictyostelids and protostelids, two other groups of mycetozoans that share some of the same microhabitats as myxomycetes. The body of data represented by the more than 5,000 collections accumulated during the project have provided evidence for a number of ecological patterns not previously reported for myxomycetes. The most important of these are that (1) both overall abundance and species richness of myxomycetes are lower in tropical forests than in temperate forests, (2) species richness of myxomycetes decreases with increasing elevation in subtropical/tropical regions of the world, (3) species richness and [especially] relative abundance increase with decreasing moisture conditions, and (4) in tropical forests, distinct assemblages of myxomycetes are associated with microhabitats that have no counterparts in temperate forests. The most extensive of the latter is the aerial litter (dead but still attached plant parts) microhabitat, where myxomycetes appear to be especially abundant and diverse. The survey, which is still ongoing, was designed to include a number of undergraduates as active participants, and more than a dozen students from Fairmont State College have been involved in either the field or laboratory components of the project.

[Lecture – ECOL]

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Bioremediation potentials of Myxomycete plasmodia

Following a report published from Finland some years ago of high levels of heavy metals found in fructifications of some Myxomycetes, we tested nine monoxenic plasmodial cultures in our collection for their tolerance of several heavy metals salts incorporated in agar media. The results far exceeded our expectations. Plasmodia of *Fuliga septica*, *Physarella oblonga* and *Physarum gyrosum* could make good growth on media containing salts of Arsenic, Cadmium, Cobalt, Zinc, copper and lead at concentrations of 7.5 to 15.0 mm, and Chromium and Nickel at 2.5 and 5.0 mm. Their bacterial associates when isolated in pure culture were found to tolerate these salts at 5.0 to 10.0 mm, including Chromium and Nickel.

The above levels being much higher than the tolerance levels reported for most microorganisms, we went on to test a few more substances which often become environmental pollutants, including fungicides, azo dyes and hydrocarbons.

The fungicides Bavastin and Iprodione were tolerated by some of the plasmodia at levels of 7.5 to 10.0 mm and by their bacterial associates, even up to 22.5 mm. The azo dye Procion Red incorporated in liquid media up to 300 µm concentration, was completely decolourized in six days by three cultures of *Physarella oblonga*, but the bacterial associates in pure culture could not tolerate the dye even at 100 µm.

Most of the plasmodia could grow on a wide range of aliphatic and aromatic hydrocarbons incorporated in agar media as the sole source of Carbon. Their bacterial associates when isolated grew poorly on these substrates. Actual degredation and utilization were studied only in a single culture of *Physarella oblonga* with diesel oil as the substrate was completely utilized within thirty days, including the pristane and phytane components which are said to be highly resistant to microbial degradation.

Tests made with a few plasmodia that were rendered axenic, showed that the special properties were present only in monoxenic cultures. The relationship of myxomycete plasmodia with specific types of bacteria is thus a very meaningful association that confers on the partners several functions which neither of them can perform in isolation.

[Lecture – FLOR 1]

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Ecological succession of Dictyostelids on the Island of Hawai'i

Patterns of ecological succession have been demonstrated for decomposer communities, but the details of such patterns with respect to the role of mycetozoans have not been addressed. Successional patterns can be inferred from a sequence of closely located sites which differ only in age, but are controlled for other sources of variation. Hawai'i, the largest and youngest of the Hawaiian Island's, offers an ideal site for such studies, consisting of variously–aged landforms underlain by similar substrates, and influenced by similar climates and biotic communities. Soil/litter samples were collected from seven mesic sites of similar elevation and rainfall, but ranging in substrate age from 67 to 7,500 ybp. Samples were processed to recover dictyostelid (cellular) slime molds according to established protocols. Preliminary results suggest that slightly different assemblages of dictyostelids occupy the soil/litter derived from different–aged parent materials. Site colonization is likely limited by the amount of suitable substrate at a site, the availability of dispersal agents arriving on site, and the total bacterial food supply within a site. These conditions are ultimately associated with the accumulation of organic material, the result of primary succession. It is predicted that the time necessary for dictyostelids to permanently colonize a site is directly related to the rate of primary succession.

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[Poster – ECOL 3]

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Occurrence of Myxomycetes on different decay states of deciduous and coniferous wood in a natural temperate forest at Southwest of Japan

D 93016

Occurrence of wood inhabiting species of myxomycetes associating with the decaying states of wood has been studied in only a few papers (Schnittler, M. and Y. K. Novozhilov 1998, Takahashi, K. 1999, 2000, 2001). This study presents the results of a seasonal study which was undertaken on the different kinds of wood with the purpose of investigating the relationships of decaying state of wood with myxomycetes in a natural temperate forest in southwest Japan.

This study area consists of deciduous broad–leaved and coniferous trees, located at Nishikuma ravine (900–1200m alt.), Monobe–mura, Kochi prefecture, southwest Japan. For the purposes of this study, I searched thoroughly for all visible myxomycete fructifications and all sporocarps that could have arisen from a single plasmodium which was defined as one specimen. About one hundred or more colonies of the fructifications were recorded on the coniferous wood and broadleaf wood at different seasons. Hardness of a portion of the splint wood on which fruiting bodies occurred was estimated using a soil hardness tester (Takemura Electric Works, Ltd). The value of the hardness was measured by mm in depth within the range of 40 mm depth. The degree of hardness of the wood was connected with the state of decay. Most of these observations were made from decorticated woods.

Fourty–seven species of wood–inhabiting myxomycetes were identified from 397 collections made from a natural temperate forest of montane zone. I investigated the number of occurrence and the area of fructification colonies of myxomycetes on the two kinds of decaying woods. *Ceratiomyxa fruticulosa*, species of *Cribraria*, *Tubifera casparyi* showed a preference for coniferous wood, while species of *Trichia*, *Arcyria*, *Hemitrichia* preferred the deciduous wood. In the progression of decay, the taxonomic groups of myxomycetes changed on the deciduous and the coniferous wood. *Cribraria* dominated typically on the soft and partly destroyed wood of conifers. The common species (*Physarum viride*, *Lycogala epidendrum*, *Arcyria cinerea*, *Cribraria cancellata*) on both kinds of wood were placed regularly according to the state of decay. The distribution pattern of 8 species on both kinds of wood had something in common. However, on the strongly decayed and softer wood, the distribution was obviously different in terms of species and colony sizes. In relation to the decay, species of *Physarum*, *Stemonitis*, *Ceratiomyxa*, *Lycogala*, *Arcyria*, *Cribraria* had occurred on the wood.

This study has obviously demonstrated that the microhabitats of the lignicolous myxomycetes were associated with the conditions of the state of decay of coniferous and the deciduous wood in a natural temperate mixed forest. This could represent the successional replacement of myxomycetes.

[Lecture – MORF]

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Morphology, soluble proteins and lipo–soluble components of *Trichia* species collected in China

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Sixteen species of *Trichia* have been reported from mainland of China (Li and Li, 1989; Li *et al.*, 1989,1990,1992; Li and Wang, 1996; Wang, 1994; Wang and Li, 1997). These specimens have been deposited in both herbaria of Jilin Agricultural University, China (HJAU) and Institute of Microorganism, Academia Sinina, China (HMAS). The soluble proteins of 7 species were analyzed by SDS–polyarcrilamide gel electrophoresis (Wang and Li, 1996). We examined morphology and lipo–soluble components of these species and discussed their phylogenetic relations based on morphological structures and chemical components.

Fruit bodies and spores of all species were observed with a light microscopy (LM) and a scanning electron microscopy (SEM). The lipo–soluble components of *T. favoginea*, *T. botrytis*, *T. scabra*, *T. varia*, *T. verrucosa* and *Metatrichia floriformis* were examined by GC/MS/DS. Spores and capillitia of these specimens were macerated with abstraction solutions of ethanol, propanol and methanol, respectively. The components were analyzed by NAS of GC/MS/DS.

A few types of chemical components including volatile dioxolane and tetrahydronaphthalene were found in the species of *Trichia* examined. *Trichia favoginea* and *T. botrytis* contained volatile dioxolane compounds, but they also contained different compounds each other. However, their morphological characteristics were different in sporangia, spore marks and sculptures of elater though they had elaters with remarkable spiral bands which were characteristics of *Trichia*. Therefore, it was indicated that these two species had some phylogenetic relations, but not so close. *Trichia scabra* and *T. verrucosa* contained a same compound, tetrahydronaphthalene, which was also found in *M. floriformis*. This compound is a secondary metabolite produced from phenylalanine and tyrosine in the same biological synthetic pathway. Therefore, it was suggested that *T. scabra* and *T. verrucosa* were phylogenetically close to *M. floriformis*. It was also suggested that *M. floriformis* was more advanced rather than these two *Trichia* species in chemical characteristics because it contained trient–cadina. In morphological observation, *M. floriformis* had stalks and valves–dehiscent sporangia with petal–like lobes which were helpful for spreading spores. These morphological characteristics were considered as more advanced ones and agreed with the results of chemical analyses. The result of SDS–PAGE also showed that *M. floriformis* had more protein bands rather than other *Trichia* species (Wang and Li, 1996). *Trichia varia* contained two kinds of compounds. One was octadecadienoic, which was an aromatic compound and might be considered as an indicator of the original group. Another one was metabolic products, unsaturated fatty acids and its biological synthetic pathway was also considered as more original. In the morphological observations, this species had sessile sporangia and only two irregular spiral bands on the capillitia. Therefore, it was suggested that this species belonged to original species for its chemical and morphological characteristics. In addition, the result of SDS–PAGE also suggested that this species was different from other *Trichia* species in the band pattern of soluble proteins. It will be required to clarify whether this species should be included into the genus *Trichia* or not.

In conclusion, it was suggested that soluble proteins and lipo–soluble components of Myxomycetes could reflect phylogenetic relations of species and were considered as helpful characteristics for Myxomycetes taxonomy.

[Poster – COLL]

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The Listers and the myxomycete collections at the Natural History Museum (BM), London

The Listers, Arthur Lister and his daughter, Gulielma, are closely associated with the collections at the BM. The three editions of '*A monograph of the Mycetozoa*' were based on the collections of Mycetozoa, as they were known then, at the Natural History Museum. Together they worked on and added to these collections. The first edition (1894) was inspired by the inclusion of the collections of C.E. Broome and H.W. Ravenal. This aroused widespread interest and an influx of material that again was worked on. Unfortunately Arthur died in 1908 but the work was carried on by Gulielma, who edited the second edition (1911), which also had better and more colour plates. The third edition (1925) added more species and more illustrations.

In addition to the collections there are the working notebooks of the Listers with coloured sketches, letters and postcards from correspondents around the world and other memorabilia.

There are also the illustration used for displays in the public galleries where they explained these fascinating organisms.

The collections are currently arranged according to B. Ing's 'A Census Catalogue of British Myxomycetes' (1968) for species occurring in the British Isles, and Martin, G.W. and Alexopoulos, C.J. 'The Myxomycetes' (1969). They contain many type species.

[Lecture – FLOR 1]

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Myxomycetes from moist chamber cultures of Neotropical substrates

B 93 o

Mexico, which has an immense variety of natural habitats and one of the richest floras in the world, was selected as an important place to study Neotropical myxomycete biodiversity. The country is known for its large number of endemic plants, and has many areas that have been declared an international priority for conservation. On three separate occasions during the period of 1999–2001, substrates for moist chamber culture were collected from a series of nine different vegetation types in Mexico. The study areas were chosen to encompass different ecological zones, from semiarid to humid tropical, and a range of elevations from lowland tropical dry forests near sea level to montane tropical cloud forests located at elevations above 1600 meters. The results of 151 moist chamber cultures prepared with 45 different substrates from living trees, vines and shrubs from these collecting trips are reported and discussed in this presentation. More than 80 different species were collected from the cultures, and this total includes many new country or state records and several rare or apparently undescribed species. Data are presented and discussed on incubation times, morphological development of some species and myxomycete–substrate associations observed. Epiphytes and other inhabitants of the substrates cultured for myxomycetes and the substrate pH are also discussed. The elevated number of cultures that were positive for myxomycetes and the abundance of some fruitings suggest that certain neotropical substrates have a richer myxomycete biota than was previously imagined, and also confirm the fact that the moist chamber culture technique is a very important tool for sampling myxomycete diversity. The presence of plasmodia, some large and well developed, that never formed fruiting bodies implies that some of these organisms could spend most of their life cycle as either myxomonads or as plasmodia in humid tropical vegetation. Observations of the timing of predation by other organisms in the cultures, almost always at the time of fructification, indicate the advantage of this strategy in moist tropical zones with abundant resources. This may result in under–assessment of myxomycete biodiversity in these areas. (This research was supported in part by grant [DEB–9705464] from the National Science Foundation and the US–Spain Science and Technology Program [Fulbright Program], Grant#99075).

[Poster – FLOR 2]

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Species diversity of myxomycetes in the Low Volga (Nizhneye Povolzhie)

D 93 020

The Low Volga is a lowland region bounded by Volgograd, Astrakhan provinces, and the Republic of Kalmykiya. The area is situated in the South–East of European Russia extending westward 800 kilometres from Volgograd to the Caspian Sea along both banks of the Volga River. The territory has a highly continental and arid climate. The snow–fall that accumulates during winter usually melts slowly and the summer storms are high–intensity, short–duration rainfall events. Aridity gradually increases from the northwest to the southeast. The Caspian lowland within the limits of the Low Volga is the region with the most intense drought in Russia. Along the borders of this area there is a broad transition from steppe to the sand and salt deserts and, in the northern part of the region, upland oak forest dominates. The Volga flows through this territory and creates an oasis, the Volga–Akhtuba flood–plain, and forms a wide delta on reaching the Caspian Sea. Everywhere in the study area the riparian forests and forest plantations occur, extending even into the desert zone.

The purposeful study of myxomycetes in this region began in 1995. Before this time there were only outline data in the monographic work of A. Yachevsky (1907). In the present study, fructifications of myxomycetes were collected both in the field and by the application of the moist chamber technique. The latter is most successful for work in the arid zone, due to the rarity of myxomycete fructifications to be found in the field during continuous drought. Substratum samples were collected systematically from all major tree and shrub species, plant litter and animal dung, each substrate being suitable for harvesting myxomycetes.

During our researches about 3000 samples were gathered, including 1000 field collections and 2000 records from the moist chamber cultures. All field samples were gathered within the limits of a steppe zone, in communities with woodland vegetation and rather higher humidity (in flood–plain of the rivers, in wash systems, near springs and reservoirs). Species from steppe and desert zonal communities were found only in moist chamber cultures.

This study has revealed a total of about 140 species, among which representatives of the orders Trichiales and Physarales prevail, with Trichiales dominating in damper habitats and members of the Physarales dominating in the more arid regions. The most frequently occurring species in the more damp conditions of the riparian woodland are: *Mucilago crustacea, Arcyria cinerea, A. pomiformis, Didymium squamulosum, Craterium leucocephalum, Physarum nutans, Ceratiomyxa fruticulosa, Comatricha nigra, C. pulchella, Stemonitis splendens, S. fusca. Didymium difforme, D. trachysporum, Physarum spinisporum, P. compressum, P. leucophaeum, P. decipiens, P. straminipes,* and *Fuligo cinerea.* These represent the typical species for steppe and desert intrazonal communities. It is worthwhile here to note an extensive and extremely high abundance of species of Perichaena: *Perichaena depressa*, *P. corticales*, *P. liceoides*, *P. chrysosperma*, *P. quadrata* in the region, found repeatedly in moist chamber cultures of substrates from almost all localities. Many species have been discovered for the first time in Russia, i.e. *Badhamia dearnessi*, *B. apiculospora*, *Physarum spinisporum*, *Didymium trachysporum*, *Tubifera casparyi*, *Hemitrichia karstenii.*

[Poster – COLL]

Japanese Society of Myxomycetology

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Japanese Society of Myxomycetology

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The Japanese Society of Myxomycetology (JSM) is an association of people who are interested in Myxomycetes. JSM aims at social and scientific exchanges between the members and encouragement of the collaboration of the members for myxomycetology. JSM was founded in 1977, and now has over 200 members. Almost all members of JSM are amateurs. However, the members have a strong desire to learn myxomycetology, and have been active in various fields. The activities of JSM are summarized as follows.

Publication: JSM publishes an annual news letter titled "The Myxomycetes", which includes scientific reports (myxomycete taxonomy, ecology and other regions), introduction of observation methods, letters from the members, the reports of JSM activity and so on.

Meetings and Field Researches: The activities of JSM include an annual meeting and lecture, biannual field research (spring and autumn), and Summer Foray.

Contribution to the special exhibition at museums: Special exhibition of Myxomycetes, "Magic of the Myxomycetes", was held at the National Science Museum, Tokyo, from December 1997 to February 1998. JSM participated in the exhibition as a supporters organization. Many members of JSM did great services to the exhibition by making and preparing many displays, guiding for visitors, and so on. The exhibition finally had about 42 thousand visitors, and achieved a great success. Similar exhibitions were held at three other public museums in 1999, 2000 and 2001.
In this presentation, the vigorous activities of JSM are introduced by showing many photographs and illustrations. We, JSM members, hope that this presentation will help the achievement of the purpose of ICSEM4: to create a forum where both amateurs and professionals can meet each other and exchange knowledge.

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Volume 7 (1996) – E. ROBBRECHT, C. PUFF & E. SMETS (eds.). **Second International Rubiaceae Conference. Proceedings**: 432 p.

Detailed written versions of 26 presentations at the Conference, arranged according to the themes Evolution, Chemistry and ethnobotany, Palaeotropical Rubiaceae, Neotropical Rubiaceae, and Biology and structure. These, together with an appended index to genera, make the book a valuable tool for angiosperm systematics and Gentianales research

Volume 8 (1999) – B. SONKÉ. ***Oxyanthus* (Rubiaceae - Gardenieae - Gardeniinae) en Afrique centrale: étude systématique**: 106 p.

A classical taxonomic revision of the central African representatives of *Oxyanthus* (17 species). Full index (covering the whole of Africa) to the taxa of the genus. In French

❊ OF INTEREST FOR THE MYCOLOGIST

Volume 9 (1998) – P. De Block. **The African species of *Ixora* (Rubiaceae - Pavetteae)**: 218 p.

Monographic treatment of the 37 native African species of the well known ornamental genus *Ixora*. Full taxonomic treatment of all species (each with illustration and distribution map). Exhaustive general part on morphology, anatomy, palynology etc.

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The Mayombe (SW of D.R.Congo) is botanically particularly rich and interesting. This book introduces to a forest reserve of world importance (MAB programme of Unesco) and documents its flora and vegetation. In French.

* Volume 11 (1997) – E. Quanten. **The polypores (Polyporaceae s.l.) of Papua New Guinea. A preliminary conspectus**: 352 p.

A revision of the polypores from the second largest island of the world. It is mainly based on more than 2,000 exsiccata made during recent Belgian expeditions to Papua New Guinea, but also incorporates other relevant material. The present first polypore conspectus of Papua New Guinea inventories 232 species (40 % of these here reported for the first time from the island). The systematic part of this book includes a full taxonomic treatment of the species, with illustrations and distribution maps. A general part deals with morphological characters and their evolution, decay and pathology, and mycogeographical considerations.

Volume 12 (2000) – R. Claßen-Bockhoff. **Inflorescences in Bruniaceae. With general comments on inflorescences in woody plants**: 310 p.

This work not only increases our knowledge of the small South African family Bruniaceae but also deals with the question of how to delimitate inflorescences in woody plants. More than 80% of the species are illustrated in detail by schematic side-views and photos. Referred to them the 'brunioid' reference framework is introduced. It differs from all concurrent concepts in strictly distinguishing caducous 'inflorescences' from persistent 'flowering shoot systems'. The study concludes with a summary of new insights into the intergeneric relationships of the Bruniaceae. It includes a critical debate of the most important morphological concepts applied to inflorescences in woody plants. For that reason it is not only addressed to morphologists and Bruniaceae specialists, but might be of general interest to all dealing with inflorescences as to systematic, morphological, ecological, genetic and evolutionary aspects.

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Back issues

Volume 1 (1992) – L. Andersson. **A provisional checklist of neotropical Rubiaceae**: 199 p.

Preliminary overview of the Rubiaceae in the neotropics, based on data collected in eight major herbaria. Distribution data in tabular form give a provisional idea of the centers of diversity of the genera. Provisional nomenclatural index with names in current usage, their basionyms and commonly recognized synonyms.

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✻ Volume 5 (1993) – J. Rammeloo & R. Walleyn. **The edible Fungi of Africa south of the Sahara: a literature survey**: 62 p.

Review of published information on importance, nutritive content, collecting, trade, culture, local tradition, etc.; 300 species are listed.

Volume 6 (1993) – P. Rasmont, Y. Barbier & A. Empain. **Microbanque Faune-Flore, logiciel de gestion de banques de données biogéographiques. Version 3.0**: xv + 200 p. + ann.

Manual to a computer programme (for the IBM PC) for the establishment and management of faunistic and floristic databases. In French.

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Volume 7 (1994) – **De relaties tussen botanische collecties en de tuinbouw**: 77 p.

Proceedings of a symposium on the relationships between botanical collections and horticulture, held in the National Botanic Garden of Belgium (March 19, 1993). In Dutch, with English abstracts.

Volume 8 (1993) – C. Cocquyt, W. Vyverman & P. Compère. **A check-list of the algal flora of the East African Great Lakes (Malawi, Tanganyika & Victoria)**: 55 p.

Summary of the knowledge on the biodiversity of the phytoplankton and -benthos of these large ecosystems.

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Literature review. Index also covering volume 5 on edible fungi.

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Volume 14 (1997) – A. Vanderpoorten. **A bryological survey of the Brussels Capital Region (Belgium)**.

Detailed mapping (225 grid maps) of the bryoflora of the Brussels Region. With discussion of specific regional frequency, floristic richness, environmental factors and conservation.

Volume 15 (1997) – E. Smets, L.P. Ronse Decraene & E. Robbrecht (eds.) **13th Symposium Morphology, Anatomy and Systematics. Programme and abstracts. Leuven, April 7-11, 1997**: 189 p.

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Volume 17 (1998) – E. COPPEJANS. **Flora van de Noord-Franse en Belgische zeewieren**: 462 p.

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Volume 18 (2000) – A. SOTIAUX, O. SOTIAUX, A. VANDERPOORTEN, L. DURWAEL, coll. A. EMPAIN. **The distribution of bryophytes in the Forest of Soignes (south of Brussels, Belgium)**: 83 p.

A detailed inventory of the bryoflora of a large forest (71 km²) just south of the conurbation of the Brussels Capital Region, based on field observations of the authors from 1980 to 1998. Grid maps are presented for the 257 bryophytes found. The data are used to list the hot spots with highest bryo-diversity and to propose management measures.

Volume 19 (2000) – J. Cheney, J. Navarrete Navarro & P. W. Jackson (eds.) **Action Plan for Botanic Gardens in the European Union**: 68 p.

The Action Plan sets out more than thirty objectives on science, horticulture, education, training, management, funding, etc., and is designed for anyone with an interest in plants and the environment. It wants to strengthen the EU botanic gardens and to foster cooperation and networking.

Volume 20 (2000) – E. ROBBRECHT & J. DEGREEF (eds.) **XVIth AETFAT Congress (August 28 - September 2, 2000). Abstracts. XVIième Congrès de l'AETFAT (28 août - 2 septembre 2000). Résumés**: 108 pp.

Volume 21 (2001) J. LÉONARD. **Flore et végétation du Jebel Uweinat (Désert de Libye: Libye, Egypte, Sudan). 6. Etude de la végétation. Analyse phytosociologique et phytochorologique des groupements végétaux**: 139 pp.

Six and last report on the results of an interdisciplinary Belgo-Libyan exploration of the Jebel Uweinat, with a phytosociological and phytochorological analysis of the fifteen vegetation types recognized. Léonard's work in the Libya desert received the Sir George Back award of the *Royal Geographical Society*, London.

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Flore Illustrée des Champignons d'Afrique Centrale

Eds. Paul Heinemann and Jan Rammeloo; 32x24 cm ; 1972 – . Each folder contains a text fascicle and plates on loose sheets. Continuation of the "Flore Iconographique des Champignons du Congo" [Fasc. 1(1935)-17(1972)].

Fully colour-illustrated (water paintings and photographs) flora of the mushrooms of Central Africa. The flora is published in French; from fasc. 10(1983) onwards, identification keys keys are translated in English and the illustrations coded, so as to make more easy usage of the flora.

Icones Mycologicae

33x25 cm; 1982 – ; species treatments (description, comments, illustrations) on loose sheets.

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Scripta Botanica Belgica 22

ICSEM 4 Congress

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ABSTRACTS

The present issue gives the abstracts of the presentations at the Fourth International Congress on Systematics & Ecology of Myxomycetes (ICSEM 4) held at the National Botanic Garden of Belgium in 2002.

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